



















# REVIEW

—OF—

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WILLIAM A. NOYES, Editor.

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# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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## INORGANIC CHEMISTRY.

**Electrolytic Chromium. I.** By H. R. CARVETH AND W. R. MOTT. *J. Phys. Chem.*, 9, 231-256.—The authors have made a very careful study of the conditions necessary for the successful precipitation of chromium from solutions of chromic chloride and sulphate. The apparatus consisted of a beaker with an inner porous cup. The outer chamber was filled with dilute sulphuric acid (sp. gr. 1.12). A lead cylinder served as the anode. The chromic solution was placed in the porous cup. A copper rod was used as cathode. The temperature was controlled by means of a glass spiral through which water at the desired temperature was allowed to flow. The following conclusions are given: The temperature and the nature of the anode solution both exert a great influence upon the efficiency of deposition of metallic chromium. The presence of chromous salt seems to be essential to the successful deposition of the chromium. The authors proved this to be the case by showing, (a) that the current does work in reducing chromic to chromous salt; (b) that it is necessary to electrolyze the chromic salt some time before the metal can be deposited with any considerable efficiency. On continued electrolysis, they find that the efficiency rises from zero to a value which is practically constant. This is accounted for on the assumption that the absolute and relative masses of chromous and chromic salt have become constant, or nearly so, under the conditions employed. The current efficiency will be affected by any factor which tends to alter this relation; *e. g.*, change in the temperature, increase in acidity, change in concentration, presence of catalyzing agents. It is suggested that in ordinary problems of electrochemistry, by the reduction of higher stages, a solution may not always result from which the metal can be deposited; for this reason, solutions in which the metal shows its lowest valency should be used when it is desirable to obtain good current efficiencies.

LAUDER W. JONES.



**Electrolytic Chromium. II.** BY H. R. CARVETH AND B. E. CURRY. *J. Phys. Chem.*, 9 (May).—An account is given of the behavior of solutions of chromic acid during electrolysis. Chromium is deposited, but a high current density is required. In the presence of an excess of acid, chromic acid may be reduced to chromic salt. The authors present experimental evidence which seems to point to the probable existence of some sexivalent chromium ions in a solution of chromic acid. They find that metallic chromium occludes as much as 150 times its volume of hydrogen.

LAUDER W. JONES.

**Preparation of Praseodymium in the Pure State.** BY CHARLES BASKERVILLE. *Z. anorg. Chem.*, 45, 86.—In reply to R. J. Meyer (*Z. anorg. Chem.*, 41, 97) who was not successful in obtaining pure praseodymium according to the citric acid method of Baskerville and Turrentine (this Journal, 26, 46), Baskerville repeats, somewhat more in detail, the directions previously given. The process is as follows: Praseodymium hydroxide must be washed free from ammonia immediately after precipitation. This prevents the formation of a colloidal hydroxide which is difficultly soluble in citric acid. The hydroxide is introduced in excess into a concentrated solution of citric acid. The liquid, with the suspended hydroxide, is shaken for one or two hours at 20°. Then it is filtered as rapidly as possible. The light green solution, when heated, deposits the light green citrate which, by the arc-spectrum, is shown to be free from lanthanum.

LAUDER W. JONES.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**The Present Standing of Applied Geology.** BY F. L. RANSOME. *Economic Geol.*, 1, 1-10.—The opening article, thoughtful and well-written, in the new journal devoted to economic geology.

W. F. HILLEBRAND.

**Secondary Enrichment in Ore-Deposits of Copper.** BY J. F. KEMP. *Economic Geol.*, 1, 11-25.—In the opening sentences the rapidly growing practical importance of the recent theory of secondary enrichment of veins is emphasized, and the influence of the character of the wall rock upon the course which this enrichment will take is referred to. The theory owes its origin and development chiefly to observations made upon copper deposits. It is now believed that in the majority of cases the starting point in copper enrichment is not chalcopyrite, but a cupriferous iron pyrites. By its oxidation in the upper parts of veins solutions carrying copper sulphate result, which in their downward course react in various ways with the unoxidized pyrite and other sulphides, whereby secondary sulphides are deposited. If the waters become alkaline through the influence



of limestone walls, the reactions will be of a different character. The author has attempted to outline by reactions largely hypothetical how copper sulphate in solution might react with some of the most important metallic sulphides, as pyrite, chalcopyrite, bornite, etc., to produce the sulphides that commonly lend richness to unoxidized deposits, chief among which is chalcocite. Suggestions are also offered to account for the formation of certain sulphides, such as enargite and tetrahedrite, which cannot well be derived from cupriferous pyrites. The reviewer notices an error in the structural formula for bornite, on p. 17, which is not derivable from the empirical formula that precedes it.

W. F. HILLEBRAND.

**The Classification of Coals.** BY M. J. R. CAMPBELL. *Trans. A. I. M. E.*, Bi-Monthly Bulletin, September, 1905, pp. 1033-49.—From chemical data obtained in the laboratory of the Coal-Testing Plant of the U. S. Geol. Survey at the St. Louis Exposition in 1904, under the direction of Professor N. W. Lord, covering a wide range of bituminous and lignitic coals, the author has arrived at provisional conclusions which he summarizes as follows: "(1) Fuel ratios or any of the components of coal, as determined by a proximate analysis, are worthless for purposes of classification except for highly carbonized fuel as anthracite, semi-anthracite and semi-bituminous coal. (2) Calorific values are equally unsuited, but in this case the failure is particularly well-marked in the upper part of the coal column. (3) Of the elements shown by an ultimate analysis, carbon is the only one at all satisfactory and this fails in detail. (4) Carbon-hydrogen ratios form a satisfactory basis for classification. This last-named scheme applies perfectly to all samples of fuel tested at St. Louis during the past year, and these include representatives of all kinds of coal except cannel and some classes of anthracite and semi-anthracite coal. (5) Twelve groups of coals and allied compounds are suggested as follows:"

	Carbon-Hydrogen ratio.
Group A (graphite).....	$\infty$
Group B } (anthracite) .....	(?) to 30 (?)
Group C } .....	30(?) to 26 (?)
Group D (semi-anthracite).....	26(?) to 23 (?)
Group E (semi-bituminous).....	23(?) to 20 (?)
Group F } .....	20 to 17
Group G } (bituminous) .....	17 to 14.4
Group H } .....	14.4 to 12.5
Group I } .....	12.5 to 11.2
Group J (lignite) .....	11.2 to 9.3
Group K (peat).....	9.3 to —(?)
Group L (wood, cellulose).....	7.2

The uncertain limits assigned to the first four groups are due to lack of sufficient ultimate analyses. W. F. HILLEBRAND.

**Hypothesis to Account for the Transformation of Vegetable Matter into the Different Grades of Coal.** BY M. R. CAMPBELL. *Economic Geol.*, 1, 26-33.—The author presents a provisional hypothesis, growing out of his extended studies in the coal fields of this country, which is summarized as follows: “(1) The change from peat to lignite, lignite to bituminous coal, and bituminous coal to anthracite is a process of fractional distillation due to heat. (2) The heat may be applied locally and with great intensity as in case of volcanic action, or it may be imperceptible but applied through a long period of time. (3) In the latter case the action is slow and of such low intensity that it is controlled largely by conditions which accelerate or retard the process. (4) The principal condition controlling distillation of this character is the porosity or impermeability of the rocks which permits or retards the escape of the gases that are formed in the process. (5) Porosity may be due, either to coarseness of grain or to fissures. Where great masses are involved the former has little or no effect, as the rocks are practically impervious, therefore, the latter is the great controlling condition of coal metamorphism. Fissures are produced by joints and by cleavage, and where these are found the coal is in a high degree of carbonization; where they are absent it is changed only slightly from the original peaty condition.”

W. F. HILLEBRAND.

**Ore Deposition and Deep Mining.** BY WALDEMAR LINDGREN. *Economic Geol.*, 1, 34-46.—In the light of recent advances in the science of ore deposits the author discusses for the different types of deposits the probabilities of the continuance of ore in paying quantities as the distance from the surface increases.

W. F. HILLEBRAND.

**Analysis of the Mississippi River.** BY C. H. STONE. *Science*, 22, 472.—There being no recent and complete analysis of Mississippi river water extant, a sample was collected near Carrollton, Louisiana, on May 23, 1905, of which the following is the analysis, expressed in parts per 100,000.

Total solids (unfiltered).....	106.9	Si	0.35
Total solids (filtered).....	16.75	Al	0.009
Loss on ignition (unfiltered).....	7.4	Mn	0.012
Loss on ignition (filtered).....	2.75	Ca	2.95
Nitrogen as free ammonia.....	0.016	Mg	0.68
Nitrogen as albuminoid ammonia.....	0.014	Fe	0.008
Nitrogen as nitrites.....	0.0000	K	0.23
Nitrogen as nitrates.....	0.023	Na	1.00
Oxygen consumed (unfiltered).....	1.42	SO <sub>4</sub>	2.87
Oxygen consumed (filtered).....	0.33	PO <sub>4</sub>	0.04
Hardness.....	10.92	CO <sub>3</sub>	0.00
Turbidity.....	heavy	HCO <sub>3</sub>	11.04
Sediment.....	large	Cl	1.61
Odor (cold).....	practically none		



Temperature 23°. Turbidity about twice the average for the year. Oxygen about 100 per cent. of saturation. Free carbonic acid about 3 parts per 100,000. W. F. HILLEBRAND.

**Genetic Relations of the Western Nevada Ores.** BY J. E. SPURR. *Bi-Monthly Bull. Am. Inst. Min. Eng.*, 1905, pp. 939-969.—The discussion of the Tonopah deposits is an abridgment of matter on the same subject in *Professional Paper No. 42*, U. S. Geol. Survey (this Journal 27, R 655). The ore deposits of the Silver Peak district fall into two chief groups: (1) Lenses of auriferous quartz associated with alaskite and separated from the same magma; (2) quartz veins due to replacement or impregnation of crushed material along fracture zones by siliceous solutions residual from the crystallization of the magma of the first type. These are more or less typical quartz veins in the pure carbonate rocks and in the granites, but in the argillaceous rocks metamorphic silicate minerals such as epidote, garnet, etc., occur. In the granite the metallic mineral is mostly pyrite; in the sedimentary strata the characteristic metallic minerals are an altered sulphide containing silver, copper, and antimony, which is provisionally called stetefeldtite, and galena. There is more gold in the granite, more silver, copper and lead in the calcareous schist. The variation in character of metal-bearing minerals and of gangue is attributed to the different precipitative action of the respective wall rocks. The mineralizing solutions are in all cases considered to have been derived from the magmas. The effect of the concentrating action of circulating ground water appears to be negligible. E. C. SULLIVAN.

**The Magmatic Origin of Vein-Forming Waters in South-eastern Alaska.** BY ARTHUR C. SPENCER. *Bi-Monthly Bull. Am. Inst. Min. Eng.*, 1905, pp. 971-978.—Water given off during the gradual consolidation of a deep-seated diorite magma is assumed to have carried the ore-forming substances. The presence of tourmaline, rutile, albite, and apatite is believed to lend weight to this hypothesis. E. C. SULLIVAN.

**The Chemistry of Ore-Deposition. Precipitation of Copper by Natural Silicates.** BY EUGENE C. SULLIVAN. *Economic Geol.* 1, 67-73.—This is a preliminary paper covering the same ground as that published in this Journal 27, 976. E. C. SULLIVAN.

**Lead and Zinc Deposits of Virginia.** BY THOMAS L. WATSON. *Bull. Geol. Survey of Virginia*, No. 1, 156 pp.; maps, plates, figures.—This first publication of the recently organized geological survey of Virginia makes a worthy beginning of the contemplated series on the mineral resources of the state. Not only are the geology, genesis and association of the ores discussed, but also

the methods of mining and smelting. Among the conclusions reached the following may be noted. The ores of the Southwest Virginia district were originally deposited with the limestone in which they were subsequently localized and concentrated and are now found. The deposit in Albemarle County occurs in crystalline schists and was connected with igneous intrusions. The ores were accumulated and concentrated by circulating underground waters, which had neither a profoundly deep circulation nor one connected with igneous rock masses. The common evidences of secondary sulphide enrichment are lacking. The oxidized ores were derived from the original galena and sphalerite. Numerous analyses by several chemists add to the value of the report.

W. F. HILLEBRAND.

**The Willamette Meteorite.** BY N. H. WINCHELL. *Am. Geologist*, 36, 250-257; plate.—The writer takes sharp issue with H. A. Ward (this Journal 26, R 474) as to the origin of the markings, channelings and pittings of this great meteorite. He thinks the cavities were formerly filled with easily soluble minerals, olivine and troilite perhaps, which have disappeared through processes of decay. It is suggested that possibly all iron meteorites may have been originally stony meteorites, whose stony parts have been dissolved away, leaving the pittings and depressions that are so characteristic of siderites.

W. F. HILLEBRAND.

**Geology of the Central Copper River Region, Alaska.** BY WALTER C. MENDENHALL. *U. S. Geol. Survey, Professional Paper No. 41*, 133 pp.; maps, plates, figures.—The chemical matter of this report is restricted to a few assay and coal tests and two detailed analyses by the reviewer of lavas from Mount Wrangell and Mount Drum, both tonaloses, though differing markedly in the hand specimens and in the mode. The economic resources of the region, so far as known, are detailed, as well as the general geology.

W. F. HILLEBRAND.

**Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the Year 1904.** BY F. B. WEEKS. *U. S. Geol. Survey, Bull. 271*, 218 pp.

W. F. HILLEBRAND.

**Field Assay of Water.** BY MARSHALL O. LEIGHTON. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 151*, 76 pp.; plates, figures.—The methods which have for some time been used with success in connection with the investigations into the quality of water in various parts of the United States by the division of hydro-economics, are herein described and discussed. The objects of the tests are to ascertain the suitability of waters for agricultural and steam-making purposes rather than their potability. The following are described: Turbidity, color, iron,



chlorine or total chlorides, total hardness, alkalinity, normal carbonates, bicarbonates, total sulphates, calcium. Necessarily the methods aim at approximate rather than exact results. With waters having a turbidity greater than 100 the improved Jackson turbidimeter is used, the turbidity rod with those showing a lower degree of turbidity. Novel is the use of standard reagent tablets for a variety of determinations, as chlorine, hardness, alkalinity, normal and acid carbonates. Sodium oleate tablets are used for the soap test. Iron is determined colorimetrically by the aid of standard color disks. Photometry is applied to the determination of calcium as well as sulphates, but its reliability in the former case has not yet been fully established.

W. F. HILLEBRAND.

**The Constitution of Certain Natural Silicates.** BY HIRAM COLVER MCNEIL. *The George Washington University Bull.*, Vol. 4, No. 3, pp. 77-79.—This is an abstract of work done in the chemical laboratory of the U. S. Geol. Survey under the supervision of F. W. Clarke, a portion of which the latter has commented on in a separate publication (see this Journal, 27, R 611), under the title "Basic Substitutions in the Zeolites." The additional matter covers experiments on talc, kaolin, halloysite and pyrophyllite. The earlier observation of Clarke and Schneider that talc breaks down on sharp blasting, yielding one-fourth of its silica in a form soluble in a solution of sodium carbonate, is confirmed. The effect of fairly strong hydrochloric acid upon the portion insoluble in the sodium carbonate solution is so pronounced as to argue against the metasilicate formula for it. "The results in general are best represented by considering the talc to contain an ortho and a trisilicate radicle, which latter on blasting is transformed into  $\text{Si}_2\text{O}_5$  group." Kaolin yields a definite compound on blasting,  $\text{Al}_2\text{Si}_2\text{O}_7$ , and not a mixture of  $\text{Al}_2\text{O}_3$  and  $\text{SiO}_2$ . This residue is but slightly attacked by hydrochloric acid, but if kaolin is dehydrated at low redness the residue is easily decomposed by the acid. There is no evidence that one-third of the aluminum in kaolin differs from the rest. Sodium carbonate solution has little effect on the residue after dehydration at either high or low temperature. Experiments on halloysite from Nevada, Texas and Kentucky show that on blasting, the residue has the composition of that from kaolin, though it is appreciably more soluble in hydrochloric acid. "The formula for kaolin, with one added molecule of water, satisfies our present knowledge of halloysite." Pyrophyllite is best regarded as a true metasilicate.

W. F. HILLEBRAND.

**Genesis of the Lake Superior Iron Ores.** BY C. K. LEITH. *Economic Geol.*, 1, 47-66.—"This paper is largely a summary of conclusions which have been presented in detail in United States Geological Survey Monographs Nos. 19, 28, 36, 43, 46 and 47 and

the Twenty-First Annual Report" by Irving, Van Hise and others. "It covers also work done since the publication of these reports." Most if not all of the reports referred to have been noticed in the pages of this Review.

W. F. HILLEBRAND.

**Provisional Methods for Copper, Lead and Zinc of the Committee on Uniformity in Technical Analysis of the Western Association of Technical Chemists and Metallurgists.** *Chem. Eng.*, **2**, 287-290.—These are the methods referred to in a recent abstract (this Journal, **27**, R 657) as having been submitted, with an ore sample, to a number of chemists for comparative tests.

W. F. HILLEBRAND.

**Sections and Analyses of Nova Scotia Coals.** BY EDWIN GILPIN, JR. *Proc. and Trans. Nova Scotian Inst. Sci.*, **11**, Part I, 8-17.

W. F. HILLEBRAND.

**On the Composition of Some Montreal Minerals.** BY B. J. HARRINGTON. *Trans. Roy. Soc. Canada*, **11**, Sec. III, 25-28.—The minerals examined are from or connected with the nepheline syenites as exposed in the Corporation Quarry at the back of Mount Royal. *Nepheline*:  $\text{SiO}_2$ , 44.98;  $\text{Al}_2\text{O}_3$ , 32.65;  $\text{Fe}_2\text{O}_3$ , 0.72;  $\text{CaO}$ , trace;  $\text{Na}_2\text{O}$ , 16.08;  $\text{K}_2\text{O}$ , 4.54;  $\text{H}_2\text{O}$ , 0.97; total 99.94. *Acmite* variety *aegirite*:  $\text{SiO}_2$ , 49.51;  $\text{TiO}_2$ , 0.61;  $\text{Al}_2\text{O}_3$ , 2.72;  $\text{Fe}_2\text{O}_3$ , 22.26;  $\text{FeO}$ , 5.82;  $\text{MnO}$ , 1.51;  $\text{CaO}$ , 7.16;  $\text{MgO}$ , 1.09;  $\text{Na}_2\text{O}$ , 8.62;  $\text{K}_2\text{O}$ , 0.38;  $\text{H}_2\text{O}$ , 0.57; total, 100.27. Hardness, nearly 6; sp. gr., 3.521. *Lepidomelane*:  $\text{SiO}_2$ , 32.96;  $\text{TiO}_2$ , 2.80;  $\text{Al}_2\text{O}_3$ , 10.34;  $\text{Fe}_2\text{O}_3$ , 8.85;  $\text{FeO}$ , 27.19;  $\text{MnO}$ , 2.79;  $\text{CaO}$ , 0.64;  $\text{MgO}$ , 0.73;  $\text{Na}_2\text{O}$ , 0.98;  $\text{K}_2\text{O}$ , 7.75;  $\text{Li}_2\text{O}$ , 0.03;  $\text{Fl}$ , none;  $\text{H}_2\text{O}$ , 4.36; total, 99.42. Hardness, 3; sp. gr., 3.269. The latter constant, as well as the proportion of  $\text{FeO}$ , is unusually high. *Natrolite*:  $\text{SiO}_2$ , 47.09;  $\text{Al}_2\text{O}_3$ , 26.99;  $\text{Fe}_2\text{O}_3$ , trace;  $\text{CaO}$ , trace;  $\text{Na}_2\text{O}$ , 16.46;  $\text{K}_2\text{O}$ , 0.01;  $\text{H}_2\text{O}$ , 9.80; total, 100.35. Hardness, 5; sp. gr., 2.234. *Analcite*:  $\text{SiO}_2$ , 54.83;  $\text{Al}_2\text{O}_3$ , 24.20;  $\text{CaO}$ , 0.08;  $\text{Na}_2\text{O}$ , 12.01;  $\text{H}_2\text{O}$ , 8.50; total, 99.62. (Analyst, J. A. E. Egleson.) Hardness, a little over 5; sp. gr., 2.22.

W. F. HILLEBRAND.

**Report on the Klondyke Gold Fields.** BY R. G. McCONNELL. *Ann. Rep. Geol. Survey Canada*, **14**, Part B, 71 pp.; maps, plates.

W. F. HILLEBRAND.

**The Artesian and Other Deep Wells on the Island of Montreal.** BY FRANK D. ADAMS AND OSMOND E. LEROY. *Ann. Rep. Geol. Survey Canada*, **14**, Part O, 74 pp.; maps, figures.—There appears to be no distinct water-bearing horizon in the form of interstratified permeable beds. The waters vary greatly in chemical character, and are represented by numerous more or less complete analyses.

W. F. HILLEBRAND.

**Report on the Coal Field of the Souris River, Eastern**



**Assiniboia.** BY D. B. DOWLING. *Ann. Rep. Geol. Survey Canada*, 15, Part F, 45 pp.; maps. W. F. HILLEBRAND.

**Mica Deposits of Canada.** BY R. W. ELLS. *Bull. Min. Resources Canada. Geol. Survey Canada*. 32 pp. **Molybdenum and Tungsten.** BY R. A. A. JOHNSTON, WITH NOTES BY C. W. WILLIMOTT. *Ibid.*, 18 pp. **Graphite in Canada.** BY R. W. ELLS. *Ibid.*, 30 pp. **Apatite.** BY R. W. ELLS. *Ibid.*, 32 pp. **On the Ores of Copper in Nova Scotia, New Brunswick and Quebec.** BY R. W. ELLS. *Ibid.*, 58 pp. W. F. HILLEBRAND.

**Preliminary Report on the Industrial Value of the Clays and Shales of Manitoba.** BY J. WALTER WELLS. [*Bull.*] *Mines Branch Dept. Interior, Canada*, 41 pp.; plates. **Preliminary Report on the Limestones and the Lime Industry of Manitoba.** BY J. WALTER WELLS. *Ibid.*, 68 pp.; plates. **Preliminary Report on the Raw Materials, Manufacture and Uses of Hydraulic Cements in Manitoba.** BY J. WALTER WELLS. *Ibid.*, 70 pp.; plates. These reports contain many analyses.

W. F. HILLEBRAND.

**Asbestos, Its Occurrence, Exploitation and Uses.** BY FRITZ CIRKEL. [*Bull.*] *Mines Branch Dept. Interior Canada*, 169 pp.; maps, plates, figures. **Mica, Its Occurrence, Exploitation and Uses.** BY FRITZ CIRKEL. *Ibid.*, 148 pp.; figures.

W. F. HILLEBRAND.

## ANALYTICAL CHEMISTRY.

**The Commercial Value of Coal Mine Sampling.** BY MARIUS R. CAMPBELL. *Trans. A. I. M. E.*, Washington Meeting, May, 1905.—The author reports on some work carried on by the Geological Survey Coal Testing Plant. Samples were taken both in the mine and from the car. Special attention was given to uniform methods of sampling, the dominant idea in the mine sampling being to make the sample represent the commercial output of the mine. Fifty separate mines in fourteen states were tested and full tables of chemical analyses are given. From these tables an average coefficient was worked out by which the moisture, ash and sulphur of the commercial product of the mine can be calculated from the analysis of the mine sample. The author also shows that the personal element enters into the question of sampling to a considerable extent. For the elimination of this personal equation the author outlines and recommends an arbitrary system of mine sampling.

FRANCIS C. KRAUSKOPF.

**Determination of Platinum and Iridium.** BY L. QUENNESSEN. *Eng. Min. J.*, 80, 15, from the *Chemical News*, 92, 29

(1905).—The alloy is dissolved in nitric and hydrochloric acids, and the excess of nitric acid expelled. Then the hot solution is diluted and the metals precipitated by magnesium. The excess of magnesium and the iridium are removed by dilute sulphuric acid, and the platinum is then dissolved in aqua regia and determined as usual. A method for the determination of the iridium is not given. The iridium as precipitated by the magnesium is soluble in dilute sulphuric acid and acetic acid and is probably in the form of an oxide.

L. F. HAWLEY.

**Some Notes on Laurent Polariscope Readings.** BY ROLFE AND FIELD. *Tech. Quart.*, September, 1905.—Reprinted from this Journal, 26, 1904.

L. F. HAWLEY.

**Quartz Plate Readings in Saccharimetry.** BY GEORGE W. ROLFE. *Tech. Quart.*, September, 1905.—A table is given of the readings of several quartz plates on (1) a U. S. standard, (2) a Schmidt and Haensch, and (3) a Scheibler half-shadow saccharimeter, the latter two being scaled for use with Mohr flasks. The ratios of readings 1:2 and 1:3 when readings are near the 100 point are very nearly 1.0024, the ratio of the true cubic centimeter to the Mohr cubic centimeter, but as the readings approach the middle of the scale the ratios become larger. This variation is explained by the fact that modern saccharimeters are graduated to give correct percentages of sugar at all concentrations, and since the specific rotation of sucrose is not a constant at all concentrations the readings of sugar solutions at different concentrations are not proportional to the thickness of the compensating quartz. Or, in other words, a quartz wedge saccharimeter, the faces of whose wedges are perfect planes and whose scale divisions are equal, does not give an exact reading of the percentage of sugar at all parts of the scale. The error has its maximum in the middle of the scale where it amounts to about 0.16 per cent. of the numerical value. According to the author the Landolt-Lippich polarizer is not as satisfactory for general laboratory use as the Laurent. A description of a simple type of sodium lamp for polariscope use is also given.

L. F. HAWLEY.

**Colorimetric Estimation of Selenium.** BY J. E. CLENNELL. *Eng. Min. J.*, October 28, 1905.—The selenium in solution as selenite or selenocyanate is treated with sodium bisulphite which precipitates very finely divided selenium varying in color from orange to scarlet, depending upon the conditions. This mixture is compared with a standard selenium solution precipitated in the same manner with addition of such ingredients as may be necessary to obtain the same kind of color. It is claimed for this method that it is possible to detect and approximately determine 1 part of selenium in 100,000 parts of solution, and if the selenium is in solution as selenite or selenocyanate and the



standards are already prepared, the test can be made in fifteen minutes.

L. F. HAWLEY.

**The Use of the Rotating Cathode for the Estimation of Cadmium Taken as the Sulphate.** BY CHARLES P. FLORA. *Am. J. Sci.*, 20, 268 (1905).—The rapid electrolytic determination of cadmium by the rotating cathode method has been described in previous articles and the thorough study of the conditions for the determination of cadmium by this method is made the object of the present investigation. Detailed accounts of the behavior of various solutions are given. The most satisfactory deposits are to be obtained from sulphate, acetate, cyanide and phosphate solutions, while solutions containing pyrophosphates, oxalates, urea and various aldehydes, formates and tartrates seems to be rather unfitted for the work, as the conditions must be very carefully observed to obtain only fair deposits of the metal and consequent accuracy. Excellent tables showing concentrations, current densities, time factors and errors are included in the article.

R. C. SNOWDON.

**The Chemical Analysis of the Incandescent Mantles.** BY T. B. STILLMAN. *Chem. Eng.*, 2, 5, 277 (1905).—A tabulated scheme giving simply an outline of a method for the detection of the possible constituents of mantles, including  $\text{ThO}_2$ ,  $\text{ZrO}_2$ ,  $\text{CeO}_2$ ,  $\text{La}_2\text{O}_3$ ,  $\text{Di}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{CaO}$ , and  $\text{MgO}$ . The author gives no results from which the completeness of the separations or the delicacy of the methods of detection may be judged.

L. F. HAWLEY.

**The Laboratory Valuation of Gas Coal.** *Amer. Gas Light J.*, 83, 410 (1905).—An editorial discussion and criticism of a coal testing plant exploited in this country by the Simplex Coke Oven and Engineering Company, Limited. The apparatus is figured both in elevation and in vertical section. It consists of a vertical iron retort heated to a temperature of from 800–900° by means of a battery of seven large Bunsen burners, or by means of a petroleum burner. The retort holds a charge of 1 kilogram of coal. The volatile products pass from the retort to a vertical annular glass condenser cooled by water, where the heavy tar is deposited, and thence to a series of wash-bottles packed with marbles which are moistened with a measured volume of standard sulphuric acid. In these wash-bottles absorption of the thinner tar and the ammonia is effected. The gas is next dried in a tube charged with lime or calcium chloride, and is passed through a wash-bottle containing a heavy tar oil which effects the removal of the benzene. The gas finally passes through an experimental meter, or, if its calorific and illuminating values are to be determined, into a small gas-holder, from which samples may be subsequently drawn. The condenser and wash-bottles may be readily

disconnected at the end of each test, in order that the amount of tar, ammonia and benzene may be determined. The apparatus is primarily designed for the use of the coke oven manager; but with certain additions it is said to be suitable for use in gas works. The editors are inclined to the opinion, however, that considerable modification of the apparatus would be necessary in adapting it to this purpose. A series of actual determinations with this apparatus of the gas-making value of various types of gas coal must be made, before final judgment concerning the usefulness of the contrivance to the gas manager can well be pronounced.

A. W. BROWNE.

## METALLURGICAL CHEMISTRY.

**The Transfer of Heat at High Temperatures.** By F. C. WAGNER. *Iron Age*, June 8, 1905 (read before the American Society Mechanical Engineers).—Records of experiments of importance to metallurgists. Plates of iron and steel  $6 \times 1.25$  inches, by 0.11 inch thick, were heated in a muffle and in an open-hearth furnace up to  $2300^{\circ}$  F. The plates had  $1/32$ -inch holes drilled through them, into which the thermo-couple of a LeChatelier pyrometer was threaded, and being placed cold in the furnace, temperatures were taken each five seconds until the temperature of the furnace had been attained. The results showed that Stephan's law ( $Q = x (T_1^4 - T_2^4)$ ) holds true, that  $x$  for wrought iron is  $2.22 \times 10^{-15}$ , and for steel  $1.72 \times 10^{-15}$ , which means that the heat absorbed per square inch of surface, per second, in British thermal units, is  $x$  times the difference of the fourth powers of the temperatures of the plate and its surroundings, expressed in absolute degrees Fahrenheit. Steel absorbs heat 20 per cent. slower than wrought iron. The heating was almost entirely by radiation, the temperature of the plates rising some  $35^{\circ}$  per second in the muffle, and  $90^{\circ}$  per second in the furnace.

J. W. RICHARDS.

**An Automatic Stock Line Recorder for Blast-Furnaces.** By J. E. JOHNSON, JR. *Iron Age*, May 4, 1905.—The apparatus consists of a test rod suspended by a chain in the top of the furnace, normally resting on the stock, but being automatically raised and then lowered again into place whenever the bell is opened and a charge introduced, combined with an attachment for automatically recording at all times the position of the rod. The record made by the instrument shows how often the furnace is charged, how fast the charge works down, and indicates at once the hanging of the charge such as leads to formation of a scaffold.

J. W. RICHARDS.

**Air Blast for the Foundry Cupola.** By W. H. CARRIER. *Iron Age*, May 11, 1905 (read before the Buffalo Foundrymen's



Association).—The writer favors using lower pressures and larger tuyeres, and fans instead of blowers. With lower pressures, more carbon is burnt to carbon dioxide, and less fuel is therefore required for melting. Proper distribution of the blast is an important factor in fuel economy. Tables are given showing the power required, air required and iron melted, in cupolas of different sizes from 30 to 70 inches internal diameter, and using air pressures of 10 to 16 ounces per square inch at the cupola.

J. W. RICHARDS.

**Melting Steel with Cast Iron.** BY R. P. CUNNINGHAM. *Iron Age*, June 8, 1905 (read before the American Foundrymen's Association, New York).—The iron and steel are charged in alternate layers into the cupola, and with the last layer of steel  $1\frac{1}{4}$  pounds of ferro-manganese for every 100 pounds of steel used. A similar amount of ferro-silicon is put into the ladle into which the melted metal is tapped, and the metal poured as soon as it is quiet. The maximum amount of steel which can be used to advantage is 33 per cent. of the charge, producing castings with 31,890 to 33,205 pounds tensile strength per square inch; ordinarily 25 per cent. of steel in the charge is recommended, giving strong, dense castings which machine well.

J. W. RICHARDS.

**Effect of Manganese in Low Silicon Cast Iron.** BY H. C. LOUDENBECK. *Chem. Eng.*, July, 1905.—The author recommends adding ferro-manganese to low silicon chilling cast-iron when the percentage of scrap used is large and that of sulphur in the iron necessarily high; the increased manganese gives lower sulphur, lower combined carbon, less chill and greater strength. Such addition is recommended wherever chilling irons are melted in a cupola and contain more than 0.07 per cent. sulphur.

J. W. RICHARDS.

**Metal Mixers for Pipe Foundries.** BY J. B. NAU. *Iron and Steel Mag.*, August, 1905.—A plea for the modification of specifications for cast-iron pipe permitting the use of direct metal from blast-furnaces, kept melted, well-mixed, and tested, in gas-fired mixing furnaces. It is claimed that when carefully looked after, such practice can give better results than metal remelted in cupolas, and save all cost of remelting. In the mixer, sulphur is reduced largely, and silicon and manganese slightly, while in the cupola silicon and manganese are largely reduced and sulphur largely increased. Any irregular composition of the direct metal could be corrected by adding to it some cold pig iron in the mixer, so as to keep the mixer metal always at the right composition.

J. W. RICHARDS.

**Chemical Changes in the Open-Hearth Furnace.** BY W. M. CARR. *Iron and Steel Mag.*, July, 1905.—Record of an acid heat

turned out at the Chicago works of the American Steel Foundries, and a basic heat made at the Granite City, Illinois works. Fuel oil was used in firing, which possibly accounted for some increase in sulphur. The sulphur in the basic heat dropped off sharply at the end, probably because of the influence of the manganese of the ferro-manganese added; under similar conditions, the sulphur in the acid heat increased sharply. In both acid and basic heats the phosphorus increased when ferro-manganese and ferro-silicon were added, in the acid heat probably because of phosphorus in these reagents; in the basic heat mostly because of the action of silicon on the slag sending phosphorus back into the iron. The charts shown are very clear.

J. W. RICHARDS.

**The Best Metal for Rails.** BY P. H. DUDLEY. *Iron and Steel Mag.*, June, 1905 (read before the International Railroad Congress).—The results of American experience are summed up in the following table, for different weights of rail per yard:

	75-pound.	80-pound.	90-pound.	100-pound.
Carbon.....	0.45 to 0.55	0.50 to 0.60	0.53 to 0.63	0.55 to 0.65
Silicon.....	0.15 to 0.20	0.15 to 0.20	0.15 to 0.20	0.15 to 0.20
Manganese.....	1.00 to 1.20	1.00 to 1.20	1.10 to 1.30	1.10 to 1.30
Sulphur, not over.....	0.08	0.08	0.08	0.08
Phosphorus, not over...	0.09	0.09	0.09	0.09

Several thousand tons of nickel steel rail for heavy service are now in use; those first made, with 0.50 carbon, were too hard, and the latest made have 0.40 carbon.

J. W. RICHARDS.

**Some Causes of Failure of Rails in Service.** BY R. JOB. *Iron and Steel Mag.*, August, 1905 (read before the American Society for Testing Materials).—In general, when failure is shown by fracture, very rapid wear or crushing, the primary cause is either: (1) pipes in the steel, (2) presence of many blow-holes, (3) excessive segregation, (4) coarse granular structure, (5) rough handling. Regarding (1), if the test butt for drop test is always taken from the top of the ingot, failures due to pipes will be very rare; they are always caused by too short cropping of the ingot tops. Blowholes are the most common defect in present mill practice; they cause a rail to gradually mash down on the track inside of a few weeks. Good service is due mainly to freedom of the steel from blowholes, slag and oxides, and in these respects modern rails are decidedly inferior to older ones. A uniform finely granular structure gives best wearing quality.

J. W. RICHARDS.

**The Thermo-Chemistry of Iron Ore Reduction and Steel Making in the Electric Furnace.** BY H. ALLEN. *Iron and Steel Mag.*, June, 1905 (from Cassier's Magazine, March, 1905).—An article intended for popular consumption, so full of errors as to have little or no scientific value.

J. W. RICHARDS.



**Metallography Applied to Foundry Work.** By A. SAUVEUR. *Iron and Steel Mag.*, June, July, 1905.—A clearly written and elementary presentation of this branch of metallography which will interest and instruct any person connected with foundry work.

J. W. RICHARDS.

**Reduction of Titaniferous Ores.** By A. LODYGUINE. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—Experiments on Canadian titaniferous iron ore in an electric furnace of 2 kilograms capacity, yielding 840 grams of iron titanium alloy, showing a loss of 16.5 per cent. of the iron present. Three different methods of treatment yielded alloys of the following compositions:

Fe .....	95.57	84.70	80.34
Si .....	0.40	0.40	1.40
S .....	0.00	0.60	0.20
P .....	0.00	0.08	0.09
Ti .....	trace	11.79	17.22
Al .....	trace	trace	trace
C .....	n.d.	n.d.	n.d.

To reduce one ton of steel, on the above manner, would require 1,570 kilo-watt hours. The slag produced in making the first iron contained Fe 22.46,  $\text{SiO}_2$  14.77,  $\text{Al}_2\text{O}_3$  14.55, CaO 8.27,  $\text{TiO}_2$  17.07. Further electric smelting of this would produce a rich ferro-titanium.

J. W. RICHARDS.

**Tin in California.** By H. E. WEST. *Eng. Min. J.*, May 4, 1905.—A review of the output of the San Jacinto mines. From 1880 to 1892 some 7,000 tons of ore were mined and concentrated to some 250 tons of 55 per cent. concentrate, which when mixed with coal and reduced in a reverberatory furnace fired by oil spray produced 100 to 125 tons of ingot tin. The refining was poorly done, so that the product was of poor quality. At these mines were worked the first pneumatic stamps used in California, the first Frue vanners used for concentrating tin ore, the first smelting of tin ore in oil-fired furnaces. The deposits may again be opened and profitably worked.

J. W. RICHARDS.

**The Michigan Smelter.** By R. T. WHITE. *Eng. Min. J.*, May 4, 1905.—The concentrate from the native copper ores contains 72 per cent. of copper and 28 per cent. of gangue. There are two melting furnaces with hearths 35 ft.  $\times$  16 ft., and two refining or casting furnaces with hearths 23 ft.  $\times$  14 ft. When the slag has been skimmed, the melted copper is tapped from the melting furnace into a refining furnace, where it is poled and cast. The slag contains 40  $\text{SiO}_2$ , 16 FeO, 11 CaO, 13  $\text{Al}_2\text{O}_3$ , 5 MgO, and 12 to 15 per cent. copper. It is smelted with lime in a cupola with 15 per cent. of fuel ( $\frac{1}{5}$  coke,  $\frac{4}{5}$  anthracite) to black copper, and slag carrying 40  $\text{SiO}_2$ , 20 FeO, 16 CaO, and only 0.75 per cent. copper.

J. W. RICHARDS.

**Economic Temperatures of Copper-Refining Solutions.** By C. F. BURGESS. *Elec. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—The temperature coefficient of the voltage drop in the tank is not independent of the distance between the electrodes, being greater when the electrodes are close together than when they are far apart. It is therefore not allowable to assume that the most economic temperature using plates  $\frac{1}{2}$  inch apart will be the same as for plates  $1\frac{1}{2}$  inches apart. The reason for this is that the transfer resistance from electrodes to solution has a greater temperature coefficient than the electrical resistivity of the electrolyte. These transfer resistances are low in neutral solutions but higher in acid solutions.

J. W. RICHARDS.

**A Rotating Diaphragm between Copper Electrodes.** By W. D. BANCROFT. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—If a graphite rod is placed in the electrolyte between copper electrodes, and is quickly reversed  $180^\circ$ , or is kept in rotation, it behaves as an ideally-reversible intermediate electrode, no visible amount of copper depositing on it although a considerable proportion of the total current flows through it. The subject leads to interesting theoretical considerations, and may possibly have practical applications in reducing the resistance of electrolytes.

J. W. RICHARDS.

**Analysis of Alloys of Copper.** By J. M. WILSON. *Chem. Eng.*, July, 1905.—A very useful account of the practical laboratory methods and reagents used in analyzing manganese bronze, phosphor bronze, babbitt metal, etc. Any one having such analyses to do will find many practical hints and observations.

J. W. RICHARDS.

**Platinum and Palladium in Certain Copper Ores.** By T. T. READ. *Eng. Min. J.*, May 25, 1905.—A discussion of the occurrence at the Rambler mine, in Wyoming. The ore contains pyrite, chalcopyrite and covellite. The platinum is present as sperrylite or metallic platinum, the palladium is present in five times the quantity of the platinum, and is probably contained in the small amount of argentiferous tetrahedrite in the ore.

J. W. RICHARDS.

**Precipitation of Gold and Silver from Cyanide Solutions.** By W. J. SHARWOOD. *Chem. Eng.*, June, 1905 (read before the California Mining Association).—A review of precipitation by charcoal, aluminum, zinc and electrolysis. Under the use of zinc dust are given results of experiments and practical working. The dust contains over 90 per cent. of zinc, and in good samples over 95 per cent. will pass a 200-mesh sieve; most of the particles are not over 0.001 inch in diameter. One pound of dust pre-



precipitates the gold out of 2 to 5 tons of solution, the precipitated gold and silver weighing 5 to 15 per cent. of the weight of zinc dust used. Over 95 per cent. of the precious metals can thus be precipitated from solutions carrying less than \$0.50 gold and \$0.10 silver per ton.

J. W. RICHARDS.

**Electrolytic Precipitation of Silver.** BY R. C. SNOWDEN. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—A study of the effect of high current density and rotation of the cathode on the deposition of silver from a nitrate solution. A very finely crystalline deposit is obtained by rotating the cathode rapidly and keeping the anode and cathode solutions separate. The size of the crystals decreases with increase of current density and increased speed of rotation. Free nitric acid decreases slightly the size of the crystals; a small amount of organic colloids added to the solution makes the deposit very amorphous and causes the precipitated metal to assume a colloidal state.

J. W. RICHARDS.

**Electrodeposition of Metals on Aluminium.** BY A. LODYGUINE. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—It was desired to deposit lead or antimony electrically on aluminium, to form storage battery plates, but no method of doing it directly could be found. The aluminium was then first coated with copper, by using a copper anode in dilute sulphuric acid, with current density  $\frac{1}{5}$  ampere per square foot. The plate can thus be very evenly copper-plated. To deposit antimony on the copper, a solution of  $\text{Sb}_2\text{S}_3$  in  $\text{Na}_2\text{S}$  is used, and  $\text{Sb}_2\text{S}_3$  in lumps as the anode, using a porous cell around the anode. The current density is the same as for copper, and the antimony weighs some  $\frac{6}{10}$  of the theoretical amount. The deposit is fine, adherent, and can be polished.

J. W. RICHARDS.

**Chromium and the Electrolysis of Chromic Acid.** BY H. R. CARVETH. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—The author substantiates the work of Geuther, done in 1856, and which has been generally regarded as incorrect, on the authority of Buff. Metallic chromium is deposited from solutions of chromic acid, using high current densities. Electrolytic chromium can occlude 250 times its volume of hydrogen. It is very hard. By having the solution acidulated with sulphuric acid, half the chromium in solution can be plated out. The platings may be industrially valuable.

J. W. RICHARDS.

**Electric Reduction of Lead Oxides.** BY A. LODYGUINE. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—Experiments to reduce electrically to the metallic state waste lead peroxide from storage

batteries. A mixture or paste was made of 200 parts of peroxide, 100 parts of salt, 300 parts of 45 per cent. sulphuric acid. Using lead electrodes a current was passed through and the mixture changed slowly to spongy lead. Three grams of lead were obtained per ampere hour, from which it is calculated that one short ton of lead could be reduced at a cost for power of \$0.87.

J. W. RICHARDS.

**Silicon.** BY F. J. TONE. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—A description of the commercial manufacture of silicon in the author's electric furnace. The following properties of this massive silicon were given: Melting-point  $1430^{\circ}\text{C}.$ ; oxidizes in air when nearly melted; sp. gr. 2.34; hardness, 6 to 7 on the mineralogical scale. When granulated and pressed into a cylinder it makes a good resistance material, varying in resistance 500 to 1 by varying the pressure. Specific resistance 2 or 3 times that of carbon. It can be cast like iron. It makes a very strong thermo-couple, many times stronger than any other element.

J. W. RICHARDS.

**Electrostatic Separation and Concentration of Ores.** BY L. I. BLAKE AND L. N. MOSCHER. *Electrochem. and Met. Industry*, May, 1905 (read before the American Electrochemical Society).—A description of this method of separation, with practical results so far obtained. The voltage used is 350,000; the total power about 1 horse-power per machine. On copper ores from various localities, 70 to 88 per cent. of the copper is obtained in the concentrates. Zinc middlings from ordinary concentration tables, carrying 23 to 50 per cent. of zinc, are now concentrated up to 45 to 62 per cent., the tailings running 3 to 9 per cent.

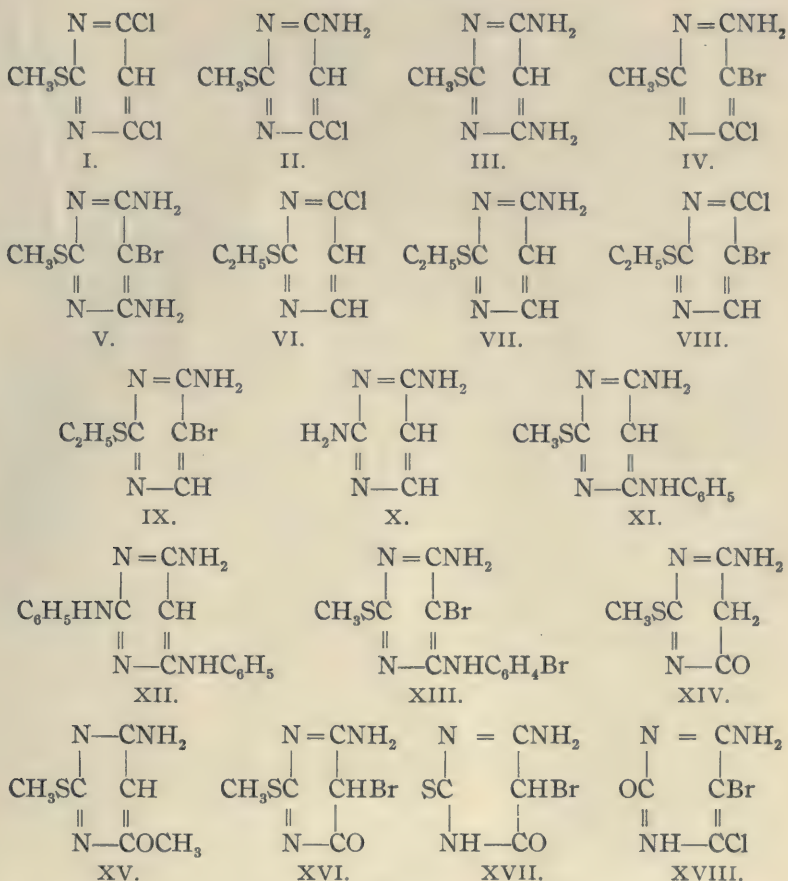
J. W. RICHARDS.

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## ORGANIC CHEMISTRY.

**Researches on Pyrimidines: The Action of Aqueous and Alcoholic Ammonia and Aniline on Some Halogen and Mercaptopyrimidines (Tenth Paper).** BY TREAT B. JOHNSON AND CARL O. JOHNS. *Am. Chem. J.*, 34, 175-191.—The object of the paper is to describe the behavior of certain halogen and mercaptopyrimidines towards ammoniacal solutions and aniline. Aqueous and alcoholic ammonia behave very differently towards such compounds. Thus, 2-methylmercapto-4,6-dichlorpyrimidine (I), when heated with alcoholic ammonia, gives 2-methylmercapto-4-chlor-6-aminopyrimidine (II). The second chlorine atom is not affected by alcoholic ammonia, but is quantitatively replaced when aqueous ammonia is used, giving the diaminopyrimidine (III). 2-Methylmercapto-4-chlor-5-brom-6-aminopyrimidine (IV) is not changed by concentrated alcoholic ammonia





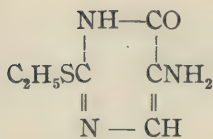
at 150–160°, but, under similar conditions, with aqueous ammonia gives a quantitative yield of 2-methylmercapto-5-brom-4,6-diaminopyrimidine (V). 2-Ethylmercapto-6-chlorpyrimidine (VI), with alcoholic ammonia, gives the corresponding aminopyrimidine (VII), but aqueous ammonia has no action upon it. 2-Ethylmercapto-5-brom-6-chlorpyrimidine (VIII), on the other hand, exchanges its chlorine quantitatively for the amino group (IX) when treated with either alcoholic or aqueous ammonia. Attempts to replace the mercapto group by the amino group showed a similar puzzling behavior on the part of the ammonia solutions. 2-Methylmercapto-4,6-diaminopyrimidine (III) and 2-methylmercapto-5-brom-4,6-diaminopyrimidine (V) were recovered unaltered after heating with both alcoholic and aqueous ammonia at 205–215°. When 2-ethylmercapto-6-chlorpyrimidine (VI) was heated with aqueous ammonia at

185–195°, 2,6-diaminopyrimidine (X) was the product. Yet, when 2-ethylmercapto-5-brom-6-chlorpyrimidine (VIII) was subjected to the same treatment, only its chlorine was replaced by the amino group (IX). The mercapto group is more readily replaced by the anilino than by the amino group. When 2-methylmercapto-4-chlor-6-aminopyrimidine (II) was heated with one molecule of aniline, only the chlorine was replaced (XI), but when two molecules of aniline were used, both the chlorine and the mercapto group were replaced by anilino groups (XII). When the former of these (XI) was treated with bromine in glacial acetic acid solution, 2-methylmercapto-4-*p*-bromanilino-5-brom-6-aminopyrimidine (XIII) resulted. The latter was also obtained by heating 2-methylmercapto-4-chlor-5-brom-6-aminopyrimidine (IV) with *p*-bromaniline. EXPERIMENTAL.—2-Methylmercapto-4-oxy-6-aminopyrimidine (XIV) was easily prepared from 2-thio-4-oxy-6-aminopyrimidine, one molecule of alcoholic sodium ethylate and one molecule of methyl iodide. It crystallizes from alcohol in colorless plates, decomposing with effervescence at 267°. 2-Methylmercapto-4-methoxy-6-aminopyrimidine (XV) was prepared in the same manner as the last, except that twice as much sodium ethylate and methyl iodide (two molecules of each) was used. It crystallizes from alcohol in prisms, m. p. 256°, soluble in acids, insoluble in alkalis. 2-Methylmercapto-4-oxy-5-brom-6-aminopyrimidine (XVI), prepared by brominating 2-methylmercapto-4-oxy-6-aminopyrimidine in glacial acetic solution, crystallizes from acetic acid in slender prisms, which begin to turn brown at 200° and do not melt below 300°. 2-Ethylmercapto-4-oxy-6-aminopyrimidine, prepared from 2-thio-4-oxy-6-aminopyrimidine in the same way as the corresponding methyl derivative (XIV), crystallizes from water in long slender prisms, m. p. 216–217°. 2-Methylmercapto-4-chlor-6-aminopyrimidine (II) has been described before by Wheeler and Jamieson. It can be more easily prepared by treating 2-methylmercapto-4-oxy-6-aminopyrimidine with phosphorus oxychloride. The yield is about 45 to 50 per cent. of the theoretical, and the product melts at 132°, instead of 126–127° as given by Wheeler and Jamieson. 2-Methylmercapto-4,6-diaminopyrimidine (III) was prepared by heating 2-methylmercapto-4-chlor-6-aminopyrimidine with concentrated aqueous ammonia for five hours at 185–195°. It has been described also by Wheeler and Jamieson. It was unaltered when heated with either aqueous or alcoholic ammonia for seven hours at 205–215°. 2-Methylmercapto-4-chlor-5-brom-6-aminopyrimidine (IV).—The hydrobromide of this pyrimidine was obtained by treating an acetic solution of 2-methylmercapto-4-chlor-6-aminopyrimidine with one molecule of bromine. It sinters at about 180–190°, and decomposes at 208° with violent effervescence. It crystallizes from acetic acid in stout prisms. The free base melts at 165°. 2-

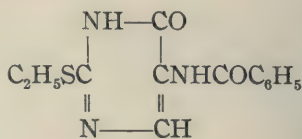


*Methylmercapto-5-brom-4,6-diaminopyrimidine* (V) was prepared by heating the last compound for four hours at 150–160° with aqueous ammonia. It crystallizes from water in beautiful prisms, m. p. 192°, and is not changed by aqueous or alcoholic ammonia at 200–214°. *2-Thio-4-oxy-5-brom-6-aminopyrimidine* (XVII), prepared by adding one molecule of bromine to an acetic acid solution of 2-thio-4-oxy-6-aminopyrimidine, separates from acetic acid in granular crystals not melting below 300°. *2-Methylmercapto-4-anilino-6-aminopyrimidine* (XI).—The *hydrochloride*,  $C_{11}H_{12}N_4S \cdot 2HCl$ , is formed by heating 2-methylmercapto-4-chlor-6-aminopyrimidine with one molecule of aniline at 100–130°. It crystallizes from alcohol in rhombic prisms, melting at 121° with violent effervescence. The *free base* crystallizes from benzene in microscopic prisms, m. p. 124°. *2,4-Dianilino-6-aminopyrimidine* (XII), from 2-methylmercapto-4-chlor-6-aminopyrimidine and two molecules of aniline at 140–150°, was purified through its *sulphate*,  $C_{18}H_{15}N_5 \cdot H_2SO_4$ . The latter crystallizes from alcohol containing sulphuric acid in granular crystals, which melt with effervescence at 190–193°. The *free base* melts at 65–70°. *2-Methylmercapto-4-p-bromanilino-5-brom-6-aminopyrimidine* (XIII). The *hydrobromide* was obtained by brominating 2-methylmercapto-4-anilino-6-aminopyrimidine in glacial acetic acid solution. It separates in stout prisms, which decompose with violent effervescence at about 290°. The *free base* crystallizes from acetic acid in long slender prisms, m. p. 202°. It may also be prepared by heating 2-methylmercapto-4-chlor-5-brom-6-aminopyrimidine with *p*-bromaniline at 120–150°, and liberating the base with alkali. *2-Oxy-4-chlor-5-brom-6-aminopyrimidine* (XVIII).—Its *hydrobromide* resulted when 2-oxy-4-chlor-6-aminopyrimidine was suspended in glacial acetic acid and treated with one molecule of bromine. It separated as an orange powder, which decomposed at 230–240° with effervescence. The *free base* crystallizes from hot water in microscopic prisms, which begin to brown at 210°, and decompose with violent effervescence at about 230°. *Action of Aqueous Ammonia on 2-Ethylmercapto-6-chlorpyrimidine*.—Heating the pyrimidine with aqueous ammonia for four hours at 140–150° caused no change; but three hours heating at 185–195° gave 2,6-diaminopyrimidine. *Action of Aqueous Ammonia on 2-Ethylmercapto-5-brom-6-chlorpyrimidine*.—When this pyrimidine was heated with aqueous ammonia for four hours at 140–150°, it was converted quantitatively into 2-ethylmercapto-5-brom-6-aminopyrimidine. Further heating with ammonia at 185–195° was without effect. M. T. BOGERT.

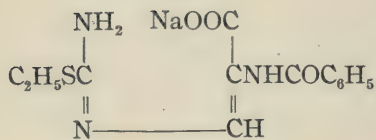
**Researches on Pyrimidines: 2-Ethylmercapto-5-Amino-6-Oxypyrimidine (Eleventh Paper).** BY TREAT B. JOHNSON. *Am. Chem. J.*, 34, 191–204.—In presence of benzene and metallic sodium, ethyl formate condenses with ethyl hippurate to form the



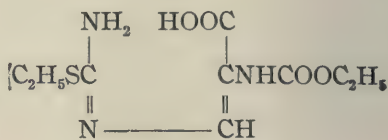
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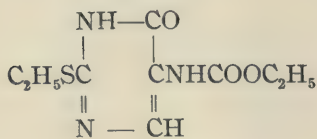
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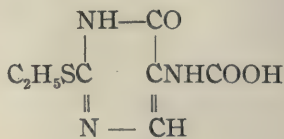
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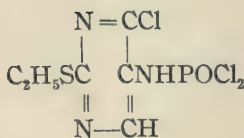
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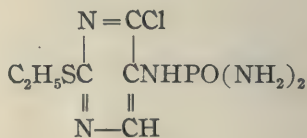
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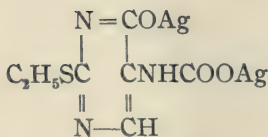
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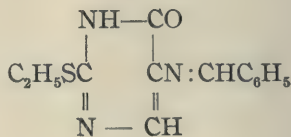
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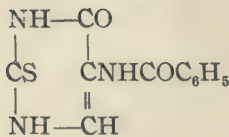
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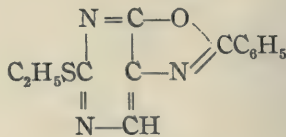
IX.



X.



XI.



XII.

sodium salt of formylethylhippurate. The latter condenses readily with pseudoethylthiourea to form the benzoyl derivative (II) of 2-ethylmercapto-5-amino-6-oxypyrimidine (I). Attempts to hydrolyze this benzoyl derivative to the free pyrimidine failed. In presence of acids, the mercapto group is easily replaced by hydroxyl. Boiling with sodium hydroxide solution opens the ring with production of the sodium salt of  $\alpha$ -benzoylamino- $\beta$ -pseudoethylthioureaacrylic acid (III). The free acid from this



sodium salt is very unstable and immediately condenses to the pyrimidine again. In presence of metallic sodium and benzene, ethyl formate condenses very smoothly with carbethoxyaminoethylacetate, to give the sodium salt of formylcarbethoxyaminoethylacetate,  $C_2H_5OOCNH.C:(CHONa)COOC_2H_5$ . This sodium salt condenses at the ordinary temperature, in aqueous solution, with pseudoethylthiourea, giving  $\alpha$ -carbethoxyamino- $\beta$ -pseudoethylthioureaacrylic acid (IV). By warming the latter with acetic anhydride, the pyrimidine (V) is obtained; and this, in turn, is changed to 2-ethylmercapto-5-amino-6-oxypyrimidine (I) by boiling with sodium hydroxide solution. The latter is also produced when the pseudoethylthioureaacrylic acid (IV) is boiled for a few minutes with sodium hydroxide solution and the solution then neutralized. When dilute alkali is used in this reaction, the carbamic acid (VI) is formed as the intermediate product. This acid is interesting because it contains a cyclic

polypeptide linking,  $HN.CO.C.NH.COOH$ . 2-Ethylmercapto-5-amino-6-oxypyrimidine reacts with phosphorus oxychloride to form an abnormally stable phosphorus compound, which appears to be a phosphoryl dichloride derivative (VII), and which when heated with alcoholic ammonia gives a compound provisionally represented as a phosphoryl triamide derivative (VIII). Recently, evidence has been produced to show that in triticonucleic acid there is a direct union between phosphorus and the nitrogen of the purine bases, and further that it is probably the nitrogen at 7 in the purine molecule that is joined to the phosphorus. It is particularly interesting, therefore, to note that the nitrogen atom in the aminopyrimidine (I) which shows such affinity for phosphorus corresponds to the nitrogen atom in position 7 in the purine nucleus. EXPERIMENTAL.—*Sodium Salt of Formylcarbethoxyaminoethylacetate*,  $C_2H_5OCONHC:(CHONa)COOC_2H_5$ , prepared from ethyl formate and carbethoxyaminoethylacetate, in benzene solution, and in presence of metallic sodium, is much more stable in the air than the sodium salt of formylethylacetate. *Trans- $\alpha$ -carbethoxyamino- $\beta$ -pseudoethylthioureaacrylic Acid (IV)* resulted when the above sodium salt and pseudoethylthiourea were mixed in aqueous solution, the clear solution thus obtained allowed to stand for a few hours, and then precipitated with acetic acid. It crystallizes from water in colorless microscopic prisms, decomposing with effervescence at  $259^\circ$ . *2-Ethylmercapto-5-carbethoxyamino-6-oxypyrimidine (V)* was easily obtained by dissolving the above *trans* acid in warm acetic anhydride and then adding water. Recrystallized from 15 per cent. acetic acid, it formed prisms, m. p.  $189-190^\circ$ . *2-Ethylmercapto-5-amino-6-oxypyrimidine (I)* was obtained either from the last compound (V) or from the above *trans* acid (IV), by the action of boiling sodium hydroxide solution, and was precipitated from its alkaline solution by acetic acid. It crystallizes from water in needles,

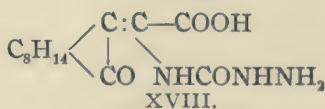
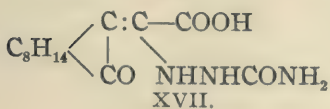
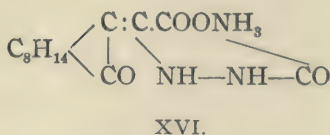
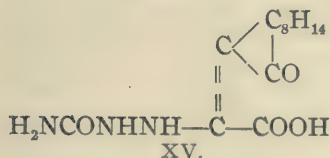
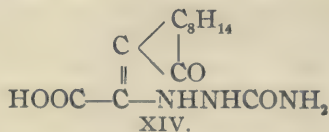
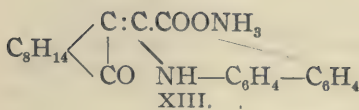
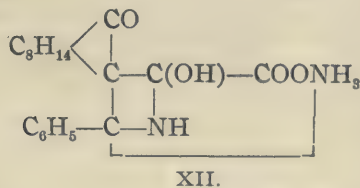
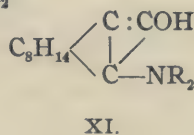
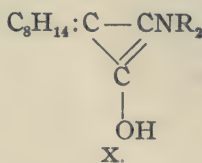
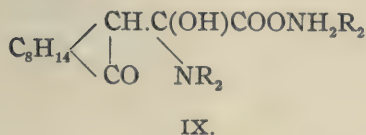
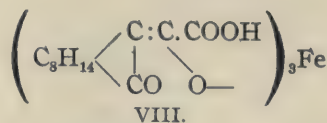
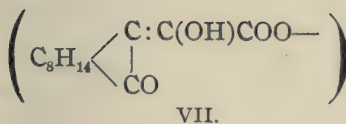
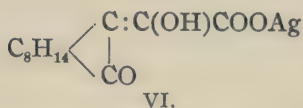
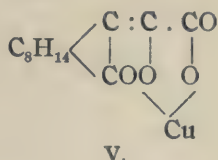
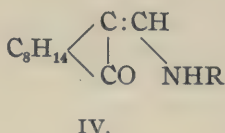
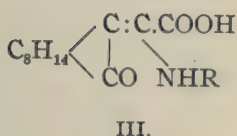
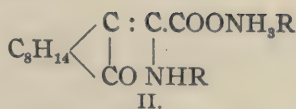
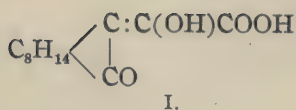
m. p. 160°. *Di-silver Salt of 2-Ethylmercapto-5-carboxylamino-6-oxypyrimidine* (IX).—When the above trans acid (IV) was boiled with dilute sodium hydroxide solution, the solution acidified with nitric acid, and silver nitrate added, this salt was obtained. It is amorphous, and difficultly soluble in water. *2-Ethylmercapto-5-phosphoryldichloramino-6-chlorpyrimidine* (VII), from 2-ethylmercapto-5-amino-6-oxypyrimidine (I) and phosphorus oxychloride, forms a yellow crystalline solid which decomposes at 247–250°. When heated with alcoholic ammonia at 160–165°, it yielded *2-ethylmercapto-5-phosphoryltri-amino-6-chlorpyrimidine* (VIII), which had a green metallic appearance, began to sinter at about 258°, and decomposed at 290–300°. *Sodium Salt of  $\alpha$ -Benzoylamino- $\beta$ -pseudoethylthioureaacrylic Acid*,  $\text{H}_2\text{N}(\text{C}_2\text{H}_5\text{S})\text{C}:\text{NCH}:\text{C}(\text{NHCOC}_6\text{H}_5)\text{COONa}$ .—This salt was prepared by boiling 2-ethylmercapto-5-benzoylamino-6-oxypyrimidine (II) with sodium hydroxide solution. It crystallizes from alcohol in needles which melt with effervescence at 124–125°. Acids change it to the pyrimidine (m. p. 239°). *2-Ethylmercapto-5-benzal-amino-6-oxypyrimidine* (X) from the aminopyrimidine (I) and benzaldehyde, crystallizes from benzene in plates or prisms, m. p. 185–187°, and on long boiling with water or dilute alcohol is slowly hydrolyzed to the aminopyrimidine and benzaldehyde again. *2-Thio-5-benzoylamino-6-oxypyrimidine* (XI), from thiourea and the sodium salt of formylethylhippurate, crystallizes from acetic acid in plates, which decompose at 300–310°. It dissolves in alkalis and is reprecipitated by acids. *2-Ethylmercapto-5,6 ( $\mu$ -phenyloxazoline)-pyrimidine* (XII) (by S. H. Clapp), from 2-ethylmercapto-5-benzoylamino-6-oxypyrimidine (II) and phosphorus oxychloride, melts at 108–109°. It is insoluble in sodium hydroxide solution and unchanged by it. Aqueous hydrochloric acid reverts it to the benzoylaminopyrimidine. Suspended in absolute benzene, and treated with dry hydrogen chloride, a *hydrochloride* was formed, which melted with vigorous effervescence at 147°, and was readily dissociated by water.

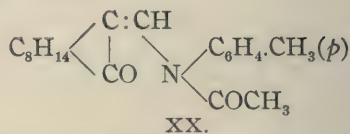
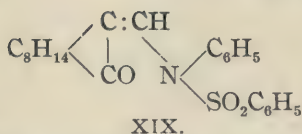
M. T. BOGERT.

### Condensation Compounds of Camphoroxalic Acid and Amines

Seventh Communication on Camphoroxalic Derivatives. By J. BISHOP TINGLE AND WILLIAM EDWIN HOFFMAN, JR. *Am. Chem. J.*, 34, 217–254.—In these formulas, R = methyl, ethyl, *m*- or *p*-tolyl, *p*-nitro-*o*-tolyl,  $\alpha$ - or  $\beta$ -naphthyl, or  $\text{NHCONH}_2$ . The object of the investigation was to determine what action would take place between free camphoroxalic acid (I) and amines. Certain salts of camphoroxalic acid were prepared and analyzed, and the action of acyl halides upon compounds of the type (IV) was also investigated. *Salts of Camphoroxalic Acid. Copper Salt* (V): greenish crystalline mass (from alcohol), which melts with decomposition at 275°, and gives no color reaction with







ferric chloride. *Silver Salt* (VI): colorless crystalline mass (from alcohol), melting with decomposition at  $137^\circ$ . *Barium Salt* (VII): colorless crystalline mass (from alcohol). The alcoholic solution gives a red-violet color with ferric chloride. *Calcium Salt* (VII): separates from alcohol in colorless crystals. *Ferric Salt* (VIII): dark red-violet compound, melting at about  $85^\circ$ . *Amine Derivatives of Camphoroxalic Acid*. (1)  *$\beta$ -Naphthylamine*.  *$\beta$ -Naphthylcamphoformeneaminecarboxylate* (II), from  *$\beta$ -naphthylamine* and camphoroxalic acid, in boiling alcoholic solution, forms fine pale-yellow needles, which melt at  $169^\circ$  with evolution of gas. The free  *$\beta$ -naphthylcamphoformeneaminecarboxylic acid* (III) crystallizes from benzene in slender bright-yellow needles, m. p.  $172.5\text{--}173^\circ$ .  *$\beta$ -Naphthylcamphoformeneamine* (IV) results on heating either of the foregoing compounds above its melting-point. It crystallizes from alcohol in slender pale-yellow prisms, m. p.  $173^\circ$ . (2)  *$p$ -Toluidine*.  *$p$ -Toluidine  $p$ -Tolylcamphoformeneaminecarboxylate* (II): pale-yellow needles (from alcohol), melting at  $152^\circ$  with evolution of gas.  *$p$ -Tolylcamphoformeneaminecarboxylic Acid* (III) crystallizes from benzene in pale-yellow prisms, melting at  $168^\circ$  with evolution of gas.  *$p$ -Tolylcamphoformeneamine* (IV); slender yellow prisms (from alcohol), m. p.  $178^\circ$ . (3) *Benzylamine*.—*Benzylamine Benzylcamphoformeneaminecarboxylate* (II); colorless irregular rhombohedra, melting at  $174.5^\circ$  with evolution of gas. *Benzylcamphoformeneaminecarboxylic acid* (III); fine colorless prisms (from ethyl acetate), m. p.  $140^\circ$ . *Benzylcamphoformeneamine* (IV); colorless prisms (from alcohol), m. p.  $96.5^\circ$ . (4)  *$\alpha$ -Naphthylamine*.— *$\alpha$ -Naphthylamine  $\alpha$ -Naphthylcamphoformeneaminecarboxylate* (II); greenish yellow prisms (from alcohol), melting at  $165^\circ$  with evolution of gas.  *$\alpha$ -Naphthylcamphoformeneaminecarboxylic acid* (III) crystallizes from benzene with half a molecule of benzene, and melts at  $170^\circ$ . (5)  *$m$ -Toluidine*.— *$m$ -Toluidine  $m$ -Tolylcamphoformeneaminecarboxylate* (II); pale lemon needles (from alcohol), m. p.  $126^\circ$ .  *$m$ -Tolylcamphoformeneaminecarboxylic acid* (III); colorless needles (from benzene), m. p.  $154^\circ$ . (6) *Diethylamine*.—*Diethylamine diethylcamphoformolaminecarboxylate* (IX), from camphoroxalic acid and diethylamine in alcoholic solution, crystallizes from alcohol in colorless needles, which melt at  $139.5^\circ$  with evolution of gas. Heated above its melting-point, it loses water and carbon dioxide, and gives a compound,  $\text{C}_{15}\text{H}_{25}\text{ON}$ , which gives a color reaction with ferric chloride, and is, therefore, not believed to be diethylcamphoformeneamine (IV); and which crystallizes from ethyl acetate in colorless needles, m. p.  $153^\circ$ .



Its formula is probably either X or XI. (7) *Dimethylamine*.—*Dimethylamine Dimethylcamphoformolamininecarboxylate* (IX); colorless needles (from acetone), melting at  $137.5^{\circ}$  with evolution of gas. Heated above its melting-point, it gives a compound,  $C_{13}H_{21}ON$ , similar to the above diethyl compound (X or XI), and crystallizing from alcohol in colorless needles, m. p.  $63^{\circ}$ . (8) *Methylamine*.—*Methylamine methylcamphoformeneaminecarboxylate* (II); slender colorless needles (from alcohol), m. p.  $172^{\circ}$ . *Methylcamphoformeneamine* (IV); colorless needles (from ethyl acetate), m. p.  $131^{\circ}$ . (9) *Benzamidine*.—Camphoroxalic acid and benzamidine react in alcoholic solution to form a compound,  $C_{10}H_{24}O_4N_2$ , which crystallizes from alcohol in colorless prisms, melting with decomposition at  $184^{\circ}$ , and for which formula XII is suggested. (10) *Benzidine*.—Benzidine and camphoroxalic acid, in alcoholic solution, give a compound,  $C_{24}H_{26}O_3N_2$ , which separates from alcohol in greenish yellow microscopic needles, which melt with decomposition at  $190^{\circ}$ , and for which Formula (XIII) is proposed. (11) *4-Nitro-2-toluidine*.—*p-Nitro-o-tolylcamphoformeneamine* (IV), from 4-nitro-2-toluidine and camphoroxalic acid, in alcoholic solution at  $150^{\circ}$ , crystallizes from alcohol in bright-yellow needles, m. p.  $192^{\circ}$ . (12) *Semicarbazide*.—*Semicarbazide camphoformeneaminecarboxylic acid* (III) was obtained when semicarbazide and camphoroxalic acid were brought together in alcoholic solution in presence of acetic acid. It crystallizes from alcohol in stout colorless prisms, m. p.  $200^{\circ}$ . By crystallization from boiling glacial acetic acid, colorless needles were obtained melting at  $209-210^{\circ}$ , of the same percentage composition as the compound of melting-point  $200^{\circ}$ , but not identical with it. The two may be stereoisomers (XIV and XV); or, there may be the formation of an inner salt (XVI), which is changed by the glacial acetic acid to an open-chain compound (XVII). In case the semicarbazide reacts with its carbamide group instead of its hydrazine group, the structure of the products would be somewhat different (XVIII). (13) *o-Phenylenediamine*.—*o-Phenylenediamine* and camphoroxalic acid, in alcoholic solution, gave the *camphoquinoxaline* compound reported in a former paper by J. B. Tingle. *Action of Acylating Agents on Camphoformene Derivatives*.—The compound previously obtained by J. B. Tingle from phenylsulphone chloride and phenylcamphoformeneamine by the Schotten-Baumann reaction, is now shown to be *phenylcamphoformeneaminephenylsulphone* (XIX). It crystallizes from benzene in colorless needles, m. p.  $133^{\circ}$ , which soon decompose in the air. *Acetyl p-tolylcamphoformeneamine* (XX), from *p*-tolylcamphoformeneamine and acetyl chloride, crystallizes from alcohol in colorless needles, m. p.  $161^{\circ}$ . Chloracetyl chloride and  $\beta$ -naphthylamine gave a colorless crystalline compound, m. p.  $63^{\circ}$ , which was too unstable to analyze. The results of these various experiments are presented also in tabular form. Several of the com-

pounds noted above have been described before by J. B. and A. Tingle. M. T. BOGERT.

**The Methoxyl Group in Certain Lignocelluloses.** BY A. S. WHEELER. *J. Elisha Mitchell Sci. Soc.*, **21**, No. 1. (See this Journal, **27**, R 516.) M. T. BOGERT.

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### BIOLOGICAL CHEMISTRY.

**The Herter Lectures. Lecture I. The Contributions of Pharmacology to Physiology.** BY HANS MEYER. *Bull. Johns Hopkins Hosp.*, **16**, 351-355. F. P. UNDERHILL.

**The Digestibility of Evaporated Cream.** BY TIMOTHY MONJONNIER. *Med. News*, **87**, 877-884.—The protein in evaporated cream digests a little more rapidly when treated with artificial gastric juice than does that of raw, pasteurized or boiled milk. By means of natural digestion experiments with a child and a man, the child was found to digest evaporated cream a little more completely than did the man. Evaporated cream, like other forms of pure milk, is an economical article of diet because its nutrients are practically all available to the needs of the body. F. P. UNDERHILL.

**An Investigation of the Influence of Adrenalin Chloride on Toxic Doses of Cocaine.** BY J. M. BERRY. *Am. J. Med. Sci.*, **130**, 893-902.—Berry shows that adrenaline will not protect the organism against toxic doses of cocaine, but rather seems to enhance the action of the latter. The results of this research are in contradiction to numerous other investigations, and the author puts forth a warning against the use of the combined drugs as a clinical measure for local anaesthesia. F. P. UNDERHILL.

**Recent Advances in the Physiology of Human Nutrition.** BY FRANK BILLINGS. *J. Am. Med. Assoc.*, **45**, 1381-1385. F. P. UNDERHILL.

**Antitoxica for Poisonous Mushroom Intoxication. A Preliminary Communication.** BY W. W. FORD. *Med. News*, **87**, 771-772.—If rabbits be treated with repeated small doses of phallin (toxic principle of *Amanita phalloides*), subcutaneously followed by large doses intraperitoneally, it is possible to immunize them against the action of multiple toxic doses. Some of the animals so treated were eventually able to withstand the injection of about five times a fatal dose and their blood serum exhibited definite antihemolytic and antitoxic properties. F. P. UNDERHILL.

**On the Decomposition Products of Epinephrin Hydrate.** BY JOHN J. ABEL AND R. DEM. TAVEAU. *J. Biol. Chem.*, **1**, 1-33.—

In which the authors offer objections to the formula,  $C_6H_5(OH)_2 \cdot CH.OH.CH_2.NH.CH_3$ , now generally accepted as most probably representing the constitution of epinephrine hydrate (adrenaline). Analytical data are also given in which it is shown that the composition of the compound may vary. F. P. UNDERHILL.

**The Influence of Thyroid-Feeding upon Poisoning by Acetonitrile.** BY REID HUNT. *J. Biol. Chem.*, 1, 33-45.—It is shown that mice fed on thyroid offer a greater resistance to acetonitrile than mice on a normal diet. It is indicated that thyroidectin (blood of thyroidectomized animals) has a slight action opposite to that of thyroid, that it slightly increases the susceptibility of mice to acetonitrile. Dried blood of normal sheep and Witte's peptone have a similar influence. Blood and peptone fed in combination with thyroid diminish the action of the latter. Thyroid slightly decreases the resistance of mice to nitroprussiate of soda and hydrocyanic acid. F. P. UNDERHILL.

**On the Action of Adrenalin on the Cerebral Vessels.** BY CARL J. WIGGERS. *Am. J. Physiol.*, 14, 452-466.—By perfusing the isolated brain under constant temperature and pressure with a suitable solution, and continuously recording the entire venous outflow, the effect of influences which alter the size of the brain vessels can be definitely ascertained. The application of an adrenaline solution to such a preparation and in such a way as not to introduce factors themselves conducive to outflow change, caused reactions which corresponded to those obtained from the vessels of other regions. These reactions, if induced through the stimulation of vaso-motor nerve ends, as claimed by certain workers, supply physiological evidence of the existence of such nerves. F. P. UNDERHILL.

**A Note on the Electric Conductivity of Blood during Coagulation.** BY ROBERT T. FRANK. *Am. J. Physiol.*, 14, 466.—It is shown that there is no constant or appreciable change in the conductivity of the blood during coagulation. F. P. UNDERHILL.

**A Study of the Metabolism in Osteomalacia.** BY J. E. GOLDTHWAIT, C. F. PAINTER, R. B. OSGOOD AND F. H. MCCRUDEN. *Am. J. Physiol.*, 14, 389-403.—The results of this investigation indicate that in osteomalacia there is at first a decalcification of the bony tissue; that the calcium is in part replaced by magnesium, but probably chiefly by an organic substance rich in sulphur, poor in phosphorus, similar to but not exactly like the normal organic matrix. If castration is performed during this period the decalcification process is checked and what has been lost is replaced. F. P. UNDERHILL.

**An Improved Cage for Metabolism Experiments.** BY WIL-



LIAM J. GIES. *Am. J. Physiol.*, **14**, 403-413.—Diagrams and photographs of a cage for metabolism experiments together with a discussion of the utility of the cage are given.

F. P. UNDERHILL.

**On the Theory of Geotropism in Paramoecium.** BY E. P. LYON. *Am. J. Physiol.*, **14**, 421-433.—Living paramoecia are precipitated by the centrifuge anterior end foremost. Therefore, the geotropic orientation is an active process. The mechanical theory for this reason can not be true. A variety of experiments show that Jensen's pressure theory is incorrect, especially the fact that geotropism is intensified in a centrifuge tube which is open away from the axis and in which, therefore, no increase in pressure above atmosphere is possible. The resistance or weight theory must be given up because paramoecia are geotropic in solutions of the same density as themselves, and in which, therefore, the resistance is the same going up as down. The specific gravity of living paramoecia was determined to be about 1.049. It seems that gravity must act directly upon the inner constitution of the cell. This must involve pressures or stresses within, which could only come about in a system of substances of different densities. It can be shown that such differences of specific gravity actually exist in the body of paramoecium. The theory which explains the facts best is therefore practically the same as the statocyst theory developed for higher animals, except that instead of a complicated sense organ and reflexes, there is here the whole mechanism of stimulation and response in a single cell.

F. P. UNDERHILL.

**The Stimulation of the Integumentary Nerves of Fishes by Light.** BY G. H. PARKER. *Am. J. Physiol.*, **14**, 413-421.—Ammocoetes is negatively phototropic and photodynamic. Its eyes are not essential in these reactions to light. Its integument is sensitive to light, and this sensitiveness is greater in the tail than in any part of the trunk or head. The terminal organs for light reception in the skin of ammocoetes are in all probability the free nerve terminations of the spinal nerves. This sensitiveness of the vertebrate skin to light is probably a remnant of that primitive condition from which the lateral retinas were derived, and possibly served as a basis from which the temperature-terminals of the skin in the higher vertebrates developed.

F. P. UNDERHILL.

**Restorers of the Cardiac Rhythm.** BY D. J. LINGLE. *Am. J. Physiol.*, **14**, 433-452.—As a result of this investigation it would appear that certain agents, such as the constant current, induction shocks, and mechanical tension, which have been considered capable of producing activity in heart strips, owe their power to the solution of sodium chloride used with them.

F. P. UNDERHILL.

**The Cleavage Products of Proteoses.** BY P. A. LEVENE. *J. Biol. Chem.*, **1**, 45-59.—Analyses of the decomposition products of protoalbumose and heteroalbumose obtained from Witte's peptone are given. It is shown that the analysis for protoalbumose is in harmony with the conclusions of Pich and of Friedmann and Hart regarding the composition of the basic constituents of the protoalbumose, but not in harmony with the conclusions of Pich that the substance contains no glycocoll, little leucine and abundant tyrosine. The results for heteroalbumose fail to corroborate the statement of Pich that heteroalbumose contains abundant glycocoll and leucine and very little or no tyrosine. According to Pich heteroalbumose resembles in its composition gelatin, which does not accord with the present work.

F. P. UNDERHILL.

**Is Protagon a Mechanical Mixture of Substances or a Definite Chemical Compound?** BY EDWARD R. POSNER AND WILLIAM J. GIES. *J. Biol. Chem.*, **1**, 59-113.—In this article is given a historical account of the old controversy as to the existence of protagon, together with evidence indicating that protagon is a mechanical mixture of substances.

F. P. UNDERHILL.

**Certain Aspects of Experimental Diabetes.** BY FRANK P. UNDERHILL. *J. Biol. Chem.*, **1**, 113-131.—See abstract this Review.

F. P. UNDERHILL.

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## INDUSTRIAL CHEMISTRY.

**The Electrolysis of Water.** BY J. W. RICHARDS. *J. Frank. Inst.*, November, 1905.—The subject is divided into three considerations, namely, experimental, theoretical and applied. In the first section, the constants of decomposition are given fully, and the phenomena observed during electrolysis referred to at considerable length. With regard to the electrolytes and electrodes, both dilute sulphuric acid and caustic soda are used; for cathodes, iron is referred to as most satisfactory for commercial work, while peroxidized lead seems to be considered by the author as the most satisfactory anode. As the current passes through the cell, heating is produced. By measuring this and using the cell as a calorimeter, its resistance can be quite accurately determined. About  $1\frac{1}{2}$  volts are required for the chemical work done, although the current does not begin to flow until the voltage is raised to considerably above this point, due to the resistance of the cell, and the necessity for overcoming the polarization, due to dissolved gases. When the cell is put under pressure, a greater current will pass with the same voltage, while the output of gas per ampere hour is decreased and the heating of the cell decreases. The reason for this is that under pressure, considerably more

hydrogen and oxygen are dissolved. This promotes recombination with loss of current, and at the same time increases the conductance of the solution. The author considers it a point to be determined as to which condition, pressure or otherwise, leads to the greatest efficiency, all points being considered. Loss of oxygen takes place not only in the way referred to by combination with hydrogen, but by the formation of persulphuric acid and hydrogen peroxide, but with very dilute solutions, such as are used in practical work, these losses are practically nil. In the case of hydrogen peroxide, the favorable condition for its formation is with acid of over 60 per cent. strength. With high current density and high concentration of acids, and with a low temperature run, ozone may be formed, but this action does not occur under the conditions of ordinary operation. The theories for the electrolysis of water are given and exemplified by formulae. The first condition is that of the water being the real conducting medium; the second, the acid, with the action of its ions upon the water being secondary; or the third, that the mixture of acid and water conduct the current. The last view the author regards as the only logical one. The chemical action is then purely at the electrodes where water may be decomposed into its constituents of hydrogen and oxygen, and sulphuric acid into hydrogen and  $\text{SO}_4$ , the  $\text{SO}_4$  then reacting with water to form oxygen and sulphuric acid. The same is true with the use of caustic soda solution. Various forms of apparatus are described, including those of D'Arsonval, in 1885, in which 30 per cent. caustic soda solution is used as an electrolyte, cylindrical sheet iron electrodes, a current density of 2 amperes per square decimeter, and the anode enclosed in a woolen bag, which served as a diaphragm. For 60 amperes of current passing through the apparatus, 100 to 150 liters of oxygen were produced daily. Latchinoff used an asbestos cloth partition, 10 per cent. caustic soda solution, 3.5 amperes per square decimeter, and 2.5 volts working tension. Dr. O. Schmidt, in 1889, constructed an apparatus built like a filter-press, in which the electrodes were bi-polar, and were in sufficient number to be used with a 110-volt lighting circuit. The electrolyte was a 10 per cent. solution of potassium carbonate. The voltage between each pair of electrodes was 2.5 volts with a current density of 2 amperes per square decimeter. The oxygen obtained was from 97 per cent. to practically 100 per cent. purity, the highest purity being obtained for medicinal purposes by passing it through a tube filled with platinized asbestos heated to  $100^\circ\text{C}$ . Schoop, in 1900, constructed an apparatus with non-conducting, non-porous partitions. This apparatus has been considerably used. With an alkaline electrolyte, iron electrodes are used, and a working voltage of 2.25 volts. With sulphuric acid of 1.235 density, hardened lead electrodes are used with a voltage of 3.6 to 3.9. The output is given as 68 liters of oxygen



and 136 liters of hydrogen per horse-power hour. Garuti, in 1892, built an apparatus with nearly complete metallic partitions between the electrodes, the working voltage being kept low enough so that the metallic partitions did not act as electrodes. Current density is from 2 to 3 amperes per square decimeter, giving a voltage of 2.45 to 3 with caustic soda solution of 21° Bé. This apparatus was modified by Siemens Bros. & Co., and Obach, so that the vessel was insulated to retain and utilize the heat. The last apparatus to be described is one of Schuekert & Co., which is only briefly referred to, due to the fact that patents have not been secured. Forms of laboratory apparatus are described, such as the familiar U-tube used in lecture demonstrations.

S. P. SADTLER.

**The Application of Peat-Fuel.** BY L. A. STILLINGS, PH.D. *Electrochem. and Met. Ind.*, November, 1905.—The author claims that few people realize the vast resources this country possesses in the form of peat available for fuel. It is claimed that the United States has 100 times the acreage of peat that Europe has, although Europe has been to a great extent dependent upon peat as fuel for many years past. The equation given for the decomposition of organic carbohydrate material with the formation of peaty substances, is given as follows:



With heat and pressure, this peat would eventually become coal, after passing through the lignite stage. The approximate percentage composition of peat is: Water, 16.4 per cent.; carbon, 41.0 per cent.; hydrogen, 4.3 per cent.; oxygen, 23.8 per cent.; nitrogen, 2.6 per cent.; ash, 11.9 per cent. Sulphur is rarely found as a constituent. The ash, the author states, will vary from a small fraction of 1 per cent. up to 10 per cent., the average for the United States being 3.07 per cent., and for German peat, 7.9 per cent. Peat is known in general as the rich, dark brown mud found in marsh and swamp lands, and when dried is always available for fuel. The greatest peat bogs in this country are the Dismal Swamp of Virginia, the Everglades of Florida, the savannahs and rice swamps of Georgia, the great lagoons of the South, and the vast sycamore and cedar swamps of the West. It is also stated that almost all of New England is one vast peat bog. The greater part of the peat as found, is water, there being only about 10 per cent. of dry matter, and the greatest difficulty in manufacturing, is, therefore, the removal of this water. Peat dried in the air will contain 20 to 40 per cent. of water. The most efficient means of removing water is to crush and press the peat by machinery. In this way the water that is contained and more or less emulsified or in the root canals, is worked out, leaving about 20 per cent. that goes into the press blocks that are produced in the machine. This is then dried absolutely, giving it a

specific gravity of about 1.5 and great hardness, and making it easy to handle. Such briquettes contain about 66 per cent. of inflammable matter, and about 96 per cent. of the heat value of lignite. In the Ziegler process the peat is carbonized in ovens, the gases that are evolved being used for the peat-coking. In addition to these gases, for every ton of peat, 350 grams of peat coke, 40 kilograms of tar, 6 kilograms of methyl alcohol, 4 kilograms of ammonium sulphate, and 6 kilograms of acetate of lime are produced. At present market prices, this amply pays for the process of coking, and leaves a fair profit. The best way of utilizing peat, as referred to by the author, is by converting it into producer gas. The cost of peat fuel is very low, not exceeding \$2 per ton delivered.

S. P. SADTLER.

**Soluble Cellulose Products.** BY HOWARD A. CUSTIS. *Textile Colorist*, September, 1905.—Guncotton was the first substitute for silk used, and although amyl acetate is the best commercial solvent, strong alcohol seems best for the purpose, as where the solution is spun the usual coagulation with water is easiest effected, due to the ready solubility of the alcohol in water. The great difficulty with guncotton (pyroxylin) is inflammability. Since the introduction of viscose by Cross, Bevan and Beadle, the use of guncotton has not progressed. The chief objections to cellulose fibers made by reversion of viscose are the color and odor. Its chief use is for artificial leather, for which application it is coated on cloth and embossed. For light-colored goods it must be bleached, which injures its strength. By treating the alkali-cellulose with sodium bisulphite and zinc oxide before treating with carbon disulphide, both objections are said to be removed. Substances well adapted for the manufacture of artificial silk are cellulose esters, such as acetyl cellulose. Until recently, very little progress had been made with the artificial product from cellulose dissolved in cuprammonium hydroxide, due largely to the resistance of the cellulose article to the reagent. This is softened, however, by means of the action of caustic alkali (mercerization), but recently it has been found possible to get strong solutions which can be quickly prepared as follows: "162 grams of dry and finely divided cellulose are thoroughly mixed at ordinary temperature with a solution of 80 grams pure caustic soda in 500 grams of water. After the mixture has been allowed to stand an hour or so, 249 grams of finely powdered copper sulphate are incorporated into the mass. It must be added slowly to prevent any marked rise in temperature. A homogeneous bright blue product results; this is known as copper-hydrate-cellulose, and is soluble in concentrated ammonia water, and is available for the production of threads, or as a coating for textiles." Alumina and calcium and zinc oxides have been used to replace the copper after having been prepared in some cases in an

analogous way. Cellulose has also been dissolved in basic nitrate and chloride of zinc. In these cases the solution is used warm, while with viscose, cellulose acetate, and the cuprammonium compound heat is avoided. The difficulty met with is that at the high temperature, the weak hydrocellulose is formed. The author gives a very interesting description of a method of making cellulose sulpho esters, by the use of a relatively weak sulphuric acid bath at first 50-60 per cent., then one of 70-80 per cent. strength, which at once gelatinizes the cellulose, is used. S. P. SADTLER.

**The Dissau Vertical Retort.** *Am. Gas Light J.*, October 16, 1905.—The manufacture of gas in vertical retorts has not been previously thought possible, due to the supposition that the weight and expansion of the coal in coking would burst the retort, and it was also thought that the gas in rising through the hot retort would be deprived of much of its illuminants. The first retorts were constructed with a lateral opening to carry off the gas, but this was soon abandoned. As the sets are now set up, ten retorts, 13.1 feet long, are arranged vertically with a generator and two regenerators as an insulated unit. The hot gases circulate freely all around the retorts. Although the temperature is very high in contact with the retorts ( $1,400^{\circ}\text{C.}$ ) the efficiency of the regenerators is such that gases leave the setting at temperatures of  $280^{\circ}$  to  $350^{\circ}\text{C.}$  The generator takes enough coke at one charging, to heat the retorts for twenty-four hours. The charge in each retort is 10 to 11 cwt. and is worked off in eight to ten hours. The capacity of each retort is about 14,120 cu. ft. per twenty-four hours. The illuminating value of the gas is about the same as with horizontal retorts, the coke considerably better, while the tar is much superior, there being no free carbon. This is due to the fact that the gas is forced to the centre of the charge and rises through it and if the retort is fully packed, does not come in contact with the hot walls of the retort. The yield of ammonia is also greater than with horizontal retorts. The percentage of naphthalene in the tar is about 50 per cent. of that in horizontal retorts. Two such settings as here mentioned are sufficient to supply the town of Dissau, Germany, with 65,000 inhabitants, with gas and the plant has been running since June, 1905.

S. P. SADTLER.

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## AGRICULTURAL CHEMISTRY.

**Recent Developments in Agricultural Science.** By A. D. HALL. *Science*, 22, 449-464.—In this address before the South African meeting of the British Association for the Advancement of Science, the author for convenience makes a distinction between that class of investigations which promise to yield immediate results and that class which may be regarded as con-



tributions to knowledge pure and simple. The investigations on fixation of free nitrogen by *B. radiculicola*, are reviewed and with reference to the efficiency of pure cultures, the opinion is advanced that a sharp distinction must be drawn between their use on old and long cultivated soils and on newly opened lands. In the former case, the soils are nearly always well supplied with the bacteria so that an increase in crop yield of more than 10 per cent. from inoculation is scarcely to be expected and even here, the efficiency would depend on the continued greater virulence of the inoculating bacteria. On newly opened lands which have hitherto not grown legumes, the inoculation is promising. The decided effect of clover and alfalfa residues on subsequent crops as shown at Rothamsted is mentioned. In discussing the fixation of nitrogen by the *Azotobacter*, the author quotes the Rothamsted experiments to show that the fixation by these organisms under clean continuous cultivation is but small. On the other hand, on grass lands, especially where the falling non-leguminous vegetation accumulates and the carbohydrate supply is large, the fixation of nitrogen is large and the relative ratios of carbon to nitrogen in two Rothamsted fields is quoted in support of the statement that the greater accumulation of nitrogen has accompanied the greater combustion of carbohydrates. In this connection calcium carbonate plays an important part. Rothamsted soils that have been chalked to from 2 to 5 per cent. of the upper 9 inches have accumulated much more nitrogen, are more easily tilled and produce larger and more nutritious crops. The lime is being removed from these plots at the rate of about 1000 pounds per year and it is only a matter of time when the present fertility will be greatly reduced. The fact that many soils of small lime content have maintained their fertility is explained by the selective action of plants in removing larger quantities of acids than of bases and to the reduction of calcium salts of organic acids to carbonates. Soil surveys should be based on geological surveys, and chemical and physical examinations must constitute a part of such a survey. While each of these by itself is of little value because of the many factors in plant production, any one of which may control production, correlation of data from many soils will enable us to draw conclusions as to the needs of a particular soil. The interpretation of the results of any investigations of soils can be truly made only when a mass of data accumulated by the use of the same methods on known soils, is compared. Our lack of knowledge of the functions of what may be called the less essential elements is pointed out, and it is stated that there is evidence that soluble silica enables the cereals to make better use of small supplies of phosphoric acid than they could otherwise do. The quality of crops is a problem upon which we have made but little progress in determining the factors controlling it. Manuring proves but a small factor as composition may vary

more with season than with manures. Dates of planting soils, except as they constitute difference in climatic conditions, have but little effect on wheat. Climate is quite a factor, but all influences are subordinate to the individuality or "variety" of the plant. Hence, the improvement in quality lies chiefly through breeding, and the work with sugar-beets is cited as an example of what may be done along this line. This line of work is particularly needed and promising in a new country. F. P. VEITCH.

**Combination Evaporating Dish and Weighing-Bottle.** By L. E. LEVI. *Hide and Leather*, 30, 34 (1905).—A brief description and illustration of a shallow, wide, stoppered glass weighing-bottle, having a capacity of about 145 cc. The weight of the dish is practically constant and the dried material may be weighed without fear of gain or loss. F. P. VEITCH.

**Analyses of Manurial Substances Forwarded for Examination, Etc.** *Bull. 104, Mass. Agr. Expt. Sta.*—Analyses of miscellaneous substances and of a number of brands of licensed fertilizers are given together with the market value of fertilizer ingredients. F. P. VEITCH.

**Fertilizer Suggestions.** By E. R. FLINT. *Bull. 81, Fla. Agr. Expt. Sta.*—A general discussion of the factors influencing soil fertility is given, and this is followed by a list of the standard raw materials used in fertilizer manufacture with a brief statement as to their nature, use and value. General formulae are also given for many vegetables, field crops and fruits. F. P. VEITCH.

**Peppers.** *Bull. 103, Lab. of Inland Rev. Dept., Ottawa, Canada.*—The bulletin gives the report of the examination of 60 samples of black pepper, and 26 samples of white pepper, secured in the open market in the various provinces of Canada. Of the 60 samples of black pepper, 31 were adulterated, and 7 of doubtful nature. Out of the 26 samples of white pepper, 10 were adulterated, and 3 were reported doubtful. The examination reported consists of total ash and microscopical examination. W. D. BIGELOW.

**Report of Food Inspection.** By C. D. HOWARD. *Sanitary Bull. New Hampshire State Board of Health*, Vol. 2, No. 9.—It is stated that the character of foods sold in New Hampshire has been greatly improved by the enforcement of the food law of that state. The majority of the dealers attempt to comply with the law, and many inferior brands of foods, formerly sold in the state, have been driven from the market. The bulletin contains the detailed report of the examination of 251 samples of food. A summary of these results is given below in tabular form.

Article.	Total number examined.	Legal quality.	Adulterated or below standard.	Per cent. of adultera- tion.
Beverages.....	14	5	9	64.3
Baking-powder and cream of tartar...	8	6	2	25.0
Canned fruits and vegetables.....	7	4	3	42.8
Condensed milk.....	5	5	0	0.0
Honey.....	10	8	2	20.0
Jellies and preserves.....	19	0	19	100.0
Ketchup.....	26	1	25	96.1
Lard.....	4	1	3	75.0
Lemon extract.....	20	5	15	75.0
Maple sugar and syrup.....	9	4	5	55.5
Molasses and syrup.....	71	42	29	40.8
Prepared meats and fish.....	21	14	7	33.3
Olive and salad oils.....	3	3	0	0.0
Vanilla extract.....	19	4	15	21.0
Cider vinegar.....	12	9	3	25.0
Miscellaneous food.....	3	2	1	33.3
Total.....	251	113	138	

W. D. BIGELOW.

**Jellies, Jams and Marmalades.** *Bull. 104, Lab. of Inland Rev. Dept., Ottawa, Canada.*—A report is given of the examination of 98 samples of the products mentioned, secured in the open market in the various Canadian provinces. The report includes the determination of soluble and insoluble solids, polarization direct and invert, preservatives and coloring-matter. The results of the work are given in the following table.

Substance.	Number examined.	Found genuine.	Containing glucose.	Containing preservatives.	Containing dyes.
Black currant jam	6	2	4	3	3
Gooseberry jam...	2	0	2	0	0
Peach jam.....	10	1	9	1	0
Plum jam.....	10	1	9	1	0
Raspberry jam....	15	5	10	3	9
Strawberry jam...	12	3	9	3	6
Total.....	55	12	43	11	18
Marmalade.....	29	13	16	1	3
Jelly.....	14	8	6	3	8
Total.....	98	33	65	15	29

W. D. BIGELOW.

**Vinegar.** *Bull. No. 2, Nebraska Food Commission.*—The bulletin gives the detailed results of the examination of 24 samples of vinegar and of 9 miscellaneous foods. The determinations made were total acid, solids, ash, alkalinity of soluble ash, and polarization. No summary is given and the results are not expressed in tabular form.

W. D. BIGELOW.

**Studies on Peaches.** By W. D. BIGELOW AND H. C. GORE. *U. S. Dept. of Agr., Bur. of Chem., Bull. 97.*—An outline of the



work described in this bulletin has already appeared in the Journal.

W. D. BIGELOW.

**A Study of the Horse Chestnut.** BY L. E. LEVI AND E. G. WILSON. *Hide and Leather*, 30, 39. (1905)—Determination of the tannin, non-tannin and soluble solids of the leaf were made weekly during the growing season.

	Soluble solids. Per cent.	Non-tannin. Per cent.	Tannin. Per cent.
Burr.....	27.57	22.39	5.18
Shell of nut.....	10.68	3.19	7.49
Whole nut.....	28.37	23.47	4.90
Leaf 1st week.....	26.02	19.52	6.50
“ 2nd week.....	23.05	19.77	3.28
“ 3rd week.....	24.08	20.55	3.53
“ 4th week.....	22.54	19.78	2.76
“ 5th week.....	21.84	18.07	3.77
“ 6th week.....	18.65	15.49	3.16
“ 7th week.....	21.15	19.28	1.87
“ 8th week.....	18.36	15.60	2.76
“ 9th week.....	20.48	17.01	3.47
“ 10th week.....	23.31	19.74	3.57
“ 11th week.....	20.19	16.82	3.37
“ 12th week.....	24.10	18.97	5.13
“ 13th week.....	18.79	15.70	3.09
“ 14th week.....	23.21	17.87	5.34
“ 15th week.....	21.62	17.19	4.43
“ 16th week.....	23.01	18.68	4.33
“ 17th week.....	21.80	18.36	3.44
“ 18th week.....	24.68	18.52	6.16
“ 19th week.....	23.97	17.38	6.59
“ 20th week.....	24.24	19.10	5.14
“ 21st week.....	25.44	19.34	6.10
“ 22nd week.....	25.67	19.34	6.33
“ 23rd week (frosted)	24.06	19.53	4.53

Pectin increased until fruit began to form and then gradually decreased. The reactions are those of a catechol tannin.

F. P. VEITCH.

**Studies on the Properties of an Unproductive Soil.** BY B. E. LIVINGSTON, J. C. BRITTON AND F. R. REID. *Bull.* 28, *Bureau of Soils, U. S. Dept. of Agr.*—The soil in question occurs in Takoma Park, Md., in a small area devoted to residences. Ordinary treatment has failed to produce a good lawn upon it. In the investigations carried on with this soil the method used has been that of measuring the transpiration of wheat seedlings grown in the soil contained in paraffined wire-baskets and of those grown in water extracts of the soil. Plants grown in the untreated soil show a stunted development as though they were suffering from a lack of water, even when this is kept at the optimum for the soil. This method has shown that such non-nutrients as tannic acid, pyrogallol, calcium carbonate, ferric hydroxide, and carbon black very much improve the condition of the soil for

growing wheat seedlings. Checks made in a number of ways eliminate the possibility that this result comes from nutrient material added or made available. The toxic condition is increased by concentrating the extract, but is removed by charring, and hence the authors conclude that the "soil contains a water-soluble non-volatile substance or substances, probably organic in their nature, which are toxic to wheat plants, causing a stunting of their growth." It is thought that this toxic material is excreted by the different plants, and this explains the "exhausting" of a soil by a one-crop system and the benefit of a rotation because the succeeding and different crop is not affected by the toxic material left by the first crop. J. H. PETTIT.

**Tobacco Investigations in Ohio.** BY GEORGE T. MCNESS AND GEORGE B. MASSEY. *Bull.* 29, *Bureau of Soils, U. S. Dept. of Agr.* J. H. PETTIT.

**Contributions to Our Knowledge of the Aeration of Soils.** BY PROF. F. H. KING, Madison, Wis., *Science*, October 20, 1905. —This is a discussion and criticism of a bulletin recently published under the above title by Dr. Edgar Buckingham, of the Bureau of Soils, U. S. Department of Agriculture, and reviewed in the August number of this Journal. Prof. King states that "it is a matter for exceeding regret that this piece of work, admirable in itself so far as it goes, should be given out by the Department of Agriculture with so much assurance of finality for its conclusions before they have been checked by even a single field observation or experiment." The conclusions as published are drawn from a mathematical consideration of rather meager laboratory data, and Professor King shows, from data obtained while he was connected with the Bureau of Soils, that breaking "up fine in a mill," or dry puddling, reduces the rate of transpiration to one-fortieth of the rate obtained when the soil is kept more nearly in its natural field condition. In connection with the influence of simple diffusion upon soil aeration, as considered in the bulletin, Professor King points out that, "if it is true that carbon dioxide was escaping from a certain soil at the rate of 0.04 of a cubic foot per day and that it was being produced at this rate in the soil below a depth of six inches," then there must have oxidized in the soil an amount of organic matter equivalent to eight tons of field-cured hay per acre. This figure is based upon a growing season of 120 days only and does not include the surface six inches of soil. Two tons of field-cured hay per acre is a good yield for ordinary lands and the growth below ground does not exceed that above. "In view of the relations to which we have called attention it is clear that the generalizations cited require critical field trials to be made, bringing them to suitable tests before they should be accepted with full confidence."

J. H. PETTIT,

**Manurial Requirements of the Leonardtown Loam Soil of St. Mary Co., Md.** BY F. D. GARDNER. *Circular No. 15, Bureau of Soils, U. S. Dept. of Agr.*—The wire-basket method devised by the Bureau was used to obtain the results given. In this method a small sample of soil is surrounded by paraffin, wheat seedlings are planted in the soil and allowed to grow about thirty days. From the loss of water by transpiration and the increase in dry matter during this short period, conclusions are drawn as to the treatment best adapted to this soil in practical farming. The yield calculated from the increase in dry matter in the seedlings is 16 bushels per acre for the poorer phase of this soil, "or far more than would probably be obtained in practice on the field." The relative growth between the untreated soil and that treated with 20 tons of manure, 6,000 pounds of lime, 500 pounds of sodium nitrate, and 500 pounds of potassium sulphate is as 100 to 230 as given in the table on page 10. Even when only 250 pounds of the nitrate and sulphate, as suggested, are used the cost of this treatment would be at least \$25.00 per acre. A relative growth of 100 to 230 means a yield of 36.8 bushels for the treated soil when 16 bushels is the yield upon the untreated. Or a gain of 20.8 bushels, which at \$0.70 per bushel is worth \$14.56. This must pay for the \$25.00 treatment. So, too, with the 10 tons of manure, 500 pounds of sodium nitrate, and 500 pounds of potassium sulphate treatment, which gives a relative growth of 195, there is a gain of 15.2 bushels worth \$10.64 and this must pay for a treatment costing at least \$15.00. Accordingly, there may be some question in regard to the statement that "potash and nitrogen in combination with manure are sufficiently beneficial to justify their application."

J. H. PETTIT.

**Manurial Requirements of the Cecil Silt Loam of Lancaster Co., S. Carolina.** BY F. D. GARDNER AND F. E. BONSTEEL. *Circular No. 16, Bureau of Soils, U. S. Dept. of Agr.*—A description and some mechanical analyses of the type are given, together with some results showing the manurial requirement as determined by the wire-basket method used in Circular No. 15. In direct opposition to the practical experience of farmers for the past generation, it is shown that phosphates and potassium salts have no effect upon this soil, nitrogen as supplied by sodium nitrate or cowpeas being the only element which materially increased the yield. The authors state that these results will be checked by field tests.

J. H. PETTIT.

## PATENTS.

MAY 2, 1905.

788,584. Charles B. Jacobs, East Orange, N. J. Assignor to Ampere Electrochemical Co., Port Chester, N. Y. Reducing



**metals.** Gold is precipitated from cyanide solutions by gaseous hydrogen phosphide in the presence of free acid. The phosphide of gold is then heated to eliminate phosphorus.

788,589. George Mitchell, Los Angeles, Cal. **Separating copper.** Silicious ore is crushed and smelted in a reducing atmosphere to fusion, by limiting air supply avoiding the union of metal with silica, then withdrawing and discharging the matte into a converter, finally withdrawing the silica and discharging it into a Bessemer converter, to lengthen the life of the lining.

788,631. Marcel Couleru, Geneva, Switzerland. **Chlorates and perchlorates.** A chloride solution is electrolyzed and the alkali neutralized by lead chloride, and the lead hydroxide changed to lead peroxide by the hypochlorites.

788,650. Henry Knoth, Birmingham, Ala. Continuous process of making **steel.** Pig metal is oxidized to reduce its silicon and carbon content, then charged in an open-hearth furnace, the slag being reserved in a molten condition to purify succeeding charges in the same or another furnace, where said slag reserve is used with other partly purified metal to utilize its basic elements.

788,664. Harman Merkel, Milwaukee, Wis. **Artificial stone.** Sawdust 7, Plicaro cement 10, made into a paste with a solution of magnesium chloride, then molded and repeatedly compressed and smoothed. Plicaro cement is magnesium oxide, magnesium and calcium carbonates, and calcium sulphate.

788,778. Carlo Lamargese, Rome, Italy. **Case hardening.** The article is packed in a mixture of silicon and charcoal made from a resinous wood, forming when heated a carburetted iron silicate.

788,780. Otto Liebknecht, Frankfort-on-Main, Germany. Assignor to Roessler and Hasslacher, New York, N. Y. **Perborates.** Molecular proportions of sodium peroxide are made to react on boric acid in the presence of water and sulphuric acid, then cooling the mixture and separating the perborate.

788,783. William Maasch, New York, N. Y. Assignor one-tenth to Vital Bessier, Brooklyn, N. Y. **Waterproof compound.** Slaked lime 2, pot cheese 6, and white lead 4 parts by weight. Used for textile fabrics, etc.

788,804. John H. Wallace, San Francisco, and James B. Speed, Berkeley, Cal. **Evaporating liquids.** A series of Liebig condensers, one surrounding the other, are connected in such a way as to produce alternate evaporations and condensations in surrounding zones.

788,813. David Baker and Wm. W. Hearne, Wayne, Pa. Treating **ores.** The fine ore is passed through a rotating kiln being oxidized in one part to remove sulphur, and in another part

slightly fused so as to cause agglomeration by melting the impurities together.

788,857. Gaston A. Thube and Louis Preaubert, Nantes, France. **Adhesive.** Fifteen parts of casein are dissolved in an alkaline solution, at  $40^{\circ}$  to  $50^{\circ}$  C., 20 parts of oil and 5 of tar added with 60 parts of water. May be used as paint oil and the proportions varied to suit the purpose.

788,862. A. L. Walker, New York, N. Y. **Copper sulphate.** Shot copper is alternately immersed and withdrawn from a deep hot bath of sulphuric acid, the heavy solution of copper sulphate being continuously withdrawn.

788,912. John A. Just, Pulaski, N. Y. **Extracting metals.** Salts of precious metals are extracted by acidified calcium chloride solution of 1.40 specific gravity.

788,943. Arthur H. Pohl, Chicago, Ill. **Electrical apparatus for curing disease.** A series of incandescent lamps are placed on a suitable support and a series of tubes provided with a mixture of radiant and phosphorescent substances are arranged alternately with said lamps.

789,074. Aurelius J. Swayze, Danville, N. J. **Potassium salts.** Potash feldspar, gypsum and carbon are powdered and fused together, and the volatile potassium salts collected in water.

789,096. Paul Julius and Ernst Fussenegger, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Azo dye.** Diazotized *p*-chloraniline is made to react on 2-naphthol-3-6-disulphonic acid, giving a browned powder soluble in hot water, making an insoluble barium salt but regenerating its constituents by tin and hydrochloric acid.

789,127. Edward Gudeman, Chicago, Ill. Continuation, S. N. 181,837. **Lump starch.** Damp starch is stirred and heated at gelatinizing temperature, then pressed into molds, dried to a hard cake, broken up and dried by kiln heat.

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789,139. Samuel Booth, London, England. Assignor to Booth's Process Limited, same place. **Printing surface composition.** Thirty parts of rosin are melted and 2 parts sulphur, 25 of wax and 3 of boiled oil stirred in, when the mass is alternately melted and cooled.

789,147. Samuel J. Edmiston, Greenwich, N. Y. **Wall facings.** Paper stock is ground up, squeezed dry, color and glue added and the whole molded and baked, then coated with shellac.

789,176. Frederic J. Smith, Elizabeth, N. J. Assignor to American Agricultural Chemical Co., New York, N. Y. **Insecticide.** A paste is made of lead arsenate and sodium sulphate

with water, the mass being maintained during mixing at a temperature above the melting-point of hydrated sodium sulphate.

789,249. Wm. W. Adams, Jr., Philadelphia, and Harry C. McKay, Essington, Pa. Assignors to American Patent Kid Co., of New Jersey. **Enameled leather.** The unbuffed grain side of tanned skins is smoothed and the grease extracted, then treated with a mixture of pyroxylin 1 part, amyl acetate 16, and linseed oil varnish 2, and enough nigrosin dissolved in amyl alcohol to give color and act as a drier. The leather is afterwards enameled.

789,252. Max Bielefeldt, Berlin, Germany. **Blasting compound.** Nitroglycerin 40, collodion cotton and wood flour 2 parts each, paraffin oil 8, naphthalene 4, potassium nitrate 5, rye flour 12, and ammonium nitrate 27 parts.

789,266. Byron S. Eldred and Carleton W. Ellis, New York, N. Y. Assignors to Eldred Process Co., same place. **Gas plant.** A coke gas generator and a bituminous coal gas producer are combined so that air and chimney gases are introduced into the bituminous retorts in regulated quantities, after which the retort gas and producer gas are mixed.

789,341. Benjamin F. Taylor, Bridgeport, Conn. Assignor to Chas. A. Coe, Boston, Mass. Treating **cotton wool.** The tenacity and resiliency of the fiber are increased by coating it with carbon from burning matter at a high temperature.

789,379. Theodorus H. Patee, Greenfield, Ind. **Static electric machine.** Means for heating one part of the machine and an ice box for cooling another part are provided, while the revolving disks are furnished with hard rubber rims capable of adjustment for length, etc.

789,416. Vigo Drewson, New York, N. Y. **Paper from corn-stalks, sugar-cane, etc.** The stock is first cut in pieces, then cooked under pressure in a caustic soda solution containing 15 to 30 per cent. by weight of sodium hydroxide calculated on the dry weight of the stock.

789,417. **As above,** with a filler added to the pulp as clay, talc, etc.

789,421. Frederick Grether, Akron, Ohio. **Cleaning pad for glass.** A fabric is filled with a mixture of sawdust, and equal parts of sodium bicarbonate and whiting.

789,438. Florentine J. Machalske, Brooklyn, N. Y. Assignor to Frederick Darlington, Great Barrington, Mass. **Calcium carbide** from phosphate rock. A mixture of phosphate rock, sodium chloride and an excess of carbon is heated in an electric furnace, producing phosphorus chloride, calcium carbide and sodium.

789,439. **As above,** but fills the furnace with nitrogen and produces cyanamides of calcium and sodium,



789,440. **As above**, but after the cyanamides are formed an alkali metal carbonate is added, and the cyanamides converted into carbonates in successive portions.

789,451-2-3. Augustin L. J. Queneau, So. Bethlehem, Pa. Assignor to New Jersey Zinc Co., New Jersey. **Metallurgical vessel**. A composite wad for a press mould is made of fire-clay and sand for the inner part, and fire-clay, sand and carborundum for the outer part of the crucible.

789,478. Henry P. Baldwin, Puunene, Hawaii. **Purifying sugar**. A viscous solution containing impurities of nearly the same specific gravity, is diluted till the impurities are heavier, and then centrifugated.

789,523. Anson G. Betts, Troy, N. Y. Refining **copper nickel alloys**. The alloy is dissolved as an anode in a solution of copper salts, the copper electrolytically deposited leaving a solution of a nickel salt, from which a nickel sulphate solution is prepared and electrolyzed with a spongy lead anode, the lead sulphate being electrolyzed to spongy lead, the sulphuric acid obtained being converted into copper sulphate and the lead ultimately to lead peroxide.

789,557. Achille Meygret, Paris, France. **Envelope for storage battery plates**. Castor oil, pyroxylin and flexible collodion in suitable proportions.

789,575. Albert G. Stevens, Cape May, N. J. **Chemical mixer for fire extinguishers**. A hopper is provided on its lower part with a circular feeder over a tank divided by a partition and adapted to hold the solution, the opening in the feeder registering alternately with each side of the partition.

789,600. Louis S. Flateau, St. Louis, Mo. **Paint compound**. Gilsonite (a kind of asphalt) is ground and sifted in naphtha, linseed oil is added, and the whole ground together.

789,607. Ludwig Grote, London, England. **Binding material**. Solution of magnesium hypochlorite 200 parts, gum tragacanth 10, and an alkaline silicate 25 parts.

789,609. Duncan A. Holmes, Samuel A. Tucker, and Edward Van Wagenin, New York, N. Y. **Arc electrode**. Made of zirconium carbide.

789,610. Robert Hulseberg, Sonneberg, Germany. **Artificial marble**. Cement 70, barytes 25, mica 5 parts and water sufficient. The mass is poured into oiled molds and dipped in alkaline lye after it has set, it is then covered with chloride of lime, which is removed after drying at 50-60° C., and the object saturated with paraffin.

789,625. Charles G. Petit, Bellevue, Paris, France. **Process engraving**. A bitumenized plate containing a developed image is made insoluble, and an additional surface of bitumen added

adapted to receive an image; this step may be repeated and the last superimposed surface treated with an etcher without hardening.

789,634. Max Schroeder, Berlin, Germany. Assignor to New Jersey Zinc Co. Recovering **sulphuric anhydride**. Gases containing sulphuric anhydride and sulphuric acid vapors are led through finely divided stone or glass wool saturated with sulphuric acid.

789,647. Richard Arens, Marxloh, Germany. **Dibasic calcium phosphate**. Monobasic calcium phosphate is heated with solutions of calcium bisulphite to 85° to 90° C.

789,648. Ralph Baggaley, Pittsburg, Pa. Continuous production of **matte**. Air is blown through melted matte, and ore added rich in fuel value and low in silica, portions of the enriched bath being withdrawn from time to time.

789,671. Julius A. Reich, Vienna, Austria-Hungary. **Alkaline fluosilicate**. The residues from the alkali process with alkaline silicofluorides is boiled with sufficient lime to convert the fluoride, then adding an acid and precipitating the alkaline fluosilicate by a salt of the alkali desired.

789,690. Geo. A. Goodson, Providence, R. I. Assignor to Goodson Electric Galvanizing Co., Minneapolis, Minn. **Coating wire with metal**. The wire is run through a bath of molten plating metal and an electric current passed through both the plating metal and the metal to be plated.

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789,721. Frank A. Decker, Philadelphia, Pa. Assignor to the Decker Manufacturing Co., Wilmington, Del. **Electrolytic apparatus**. The positive electrode is carbon, and the negative electrode is formed of many trays containing mercury, arranged one above the other, each tray projecting on both sides of a sectional wall sealed into the mercury so that deposits can be readily removed from the outside of the cell. Adapted for the electrolysis of salts of Zn, Mg, Na, K or Cr or spent battery solutions.

789,740. Woolsey McA. Johnson, Iola, Kans. **Electrolytic apparatus**. Consists of a vessel containing anodes of lead arranged so as to be rotated and having vanes for directing streams of the electrolyte against the cathodes.

789,810. Alfred J. Knight, Melrose, Mass. Assignor one-half to Jesse B. Thomas, Boston, Mass. **Chemical fire-extinguisher**. There is a canister having an outlet, below which there is a diaphragm, having an opening in which is supported an acid receptacle. Means are provided to prevent splashing of the liquid when the apparatus is in the normal position, and to allow free passage of the gases and liquid when it is in operation.

The acid receptacle extends partly through the diaphragm and is kept closed by a gravity closure.

789,811. George F. Kunz, New York, N. Y. **Luminous composition.** Radium or other radio-active substance, and a zinc compound, as willemite and oil or other liquid are enclosed in a translucent casing as rock crystal.

789,812. Same. **Luminous composition.** Composed of a radio-active body as radium, a radio-responsive substance as kunzite and a translucent covering as rock crystal.

789,858. John A. Just, Pulaski, N. Y. **Evaporated milk.** Milk is partly digested at a temperature of 100° to 110° F., and is then quickly evaporated at a temperature not less than 212° F. to a dry sterilized powder. Pepsin is used as the digestant; casein and a suitable quantity of fat are added.

789,891. Thomas L. Thompson, Kingfisher, Okla. **Washing compound.** Consists of sal soda soap, and paraffin 4 parts each, rosin and borax 1 part each and sodium bicarbonate 2 parts.

789,902. Max Engelmann, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Dialkyl barbituric acid.** Dialkylmalonyldiamide is condensed with neutral carbonic esters by means of alkaline condensing agents, diethyl carbonic ester and sodium ethylate being specified, and the resulting 5-diethyl-2,4,6-trioxypyrimidine is isolated.

789,943. Alfred E. Stanley, Ellinwood, Kans. Assignor one-half to Clarence E. Atchinson. **Explosive compound.** An explosive compound composed of cornmeal 16 parts boiled in an equal amount of water, sulphur, glycerol, alcohol, and saltpeter 1 part each, and chlorate of potash 16 parts. The mixture is dried and granulated.

789,952. Joseph A. Anker, James H. Watson and Pierce Evans, Los Angeles, Cal. Anker and Evans assignors to Watson. **Process of roasting ores.** Means are provided whereby several flames are introduced into a shaft and shelf furnace. The ore carried past the flames, and collected in heaps alternately between the flames on the shelves, and then slowly dumped so as to drop it in thin streams. At the same time air blasts are introduced into the chamber at various points to secure complete chemical action.

789,977. Isidor Kitsee, Philadelphia, Pa. **Treatment of cotton-seed.** Cotton-seed is subjected to first nitrosulphuric acid, then water, then acetone by which its adherent fiber becomes nitrated, dissolved and removed.

789,978. Same. **Treatment of cotton-seed.** The hull is first broken up and the kernel removed. It is then subjected to nitration and the nitrated fibers dissolved, as in 989,977.



790,035. Felix Deusy, San Francisco, Cal. **Treating molasses.** A process by which the density of molasses is increased by osmosis, by causing initial molasses and water to flow in opposite directions. The molasses is made to enter the bottom of the apparatus and the water at the top. A portion of the osmosed liquid is collected and returned to the liquid undergoing osmose.

790,036. Same. **Refining sugar.** Osmose molasses is mixed with sugar syrup, the mixture boiled and sugar separated and refined. The molasses residue so obtained is reosmosed, the exosmose water is concentrated to the state of saline molasses, is osmosed and the sugar recovered from the molasses and potassium salts from the water. The reosmose water is treated with sodium nitrate, the mixture boiled, and the salts of potassium collected in settling tanks.

790,079. Robert E. Schmidt and Arnold Fischer, Elberfeld, Germany. Assignors to the Farbenfabriken of Elberfeld Co., New York, N. Y. **Alizarin dye.** Obtained by treating alizarin-blue in acid solution with formic aldehyde. The dye-stuff is, after being dried and pulverized, a dark powder soluble in sulphuric acid with a reddish brown color and dissolved by ammonia and caustic soda-lye with a green color; combining with alkaline bisulphites yielding compounds which are soluble in water and which produce from gray to black level shades on printing cotton with acetate of chromium.

790,089. Leon Thomas, Paris, France. **Explosive composition.** An explosive compound made up of nitroglycerin 50, dinitrotoluene 10, nitrocellulose 3.5, saltpeter 30.8, cellulose 5.5, and soda 0.2 parts.

790,116. Alfred Einhorn, Munich, Germany. Assignor to Farbwerke, vorm. Meister, Lucius und Brüning, Höchst-on-Main, Germany. **Diethylbarbituric acid.** Dialkylbarbituric acid is obtained by heating dialkylthiobarbituric acids with acids, sulphuric acid of 33 per cent. strength being specified.

790,138. Alfred Koeliker, Bouel, Germany. **Obtaining nicotine.** An extract of tobacco containing sulphuric acid is mixed with a lye of sodium hydroxide to neutralize the acid, and is then distilled. Sulphuric acid is added to the distillate, which is then evaporated until crystallization takes place and a lye of caustic soda is added to obtain an alkaline reaction.

790,167. Julius Abel, Mannheim, and Arthur Lüttringhaus, Ludwigshafen-on-the-Rhein, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Blue sulphur dye.** An alkali salt of a *p*-amino-*p*-*r*-hydroxydiarylamine body is heated with sulphur. The resulting compound is difficultly soluble in cold sodium sulphide solution, but more soluble in hot sodium sulphide, yielding a pale yellow, without the intermediate formation of a blue solution, and from the hot solution vegetable fiber takes up a

leuco compound, which, on exposure to the air, becomes pure blue.

790,238. Henry M. Wilcox, Chicago, Ill. Assignor to Esmeralda Copper Precipitating Co., Chicago, Ill. **Recovering copper.** Copper ores are leached with a solution suitable to produce a copper sulphate solution; iron is removed by blowing in air, and it is treated with sulphur dioxide, and heated under pressure suited for the precipitation of metallic copper.

790,263. Ernest Preiswerk, Basel, Switzerland. Assignor to The Firm of Society of Chemical Industry in Basel, same place. **C-C-Dialkylbarbituric acids.** The alkyl esters of carbonic acid are condensed with dialkylmalonamides by means of sodium ethylate.

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790,308. Joseph Nenatowich, Page, N. Y. **Lubricating compound.** A lubricating compound composed of tallow 40, cylinder oil and salt 8 each, soda 16, water 8, alum 8, oil of coconut and camphor 2 each.

790,363. John Hagenbach, Basel, Switzerland. Assignor to the Anilin Color and Extract Works, formerly John R. Geigy, Basel, Switzerland. **Nitro-azo dye.** A dye produced by combining the nitronaphthalene-1-2-diazooxide-4-sulphonic acid with  $\beta$ -naphthol, being in form of its sodium salt a brownish black powder with metallic luster, easily soluble in water with a dark blue color, separating a reddish brown precipitate on addition of a mineral acid, and dyeing a wool from acid bath dark reddish brown, which shade, by after treatment by bichromate, changes into soot-black, extremely fast to light.

790,364. Same. **Azo dye.** A monoazo dye which results by sulphonation of the azo dye-stuff obtained by combination of the anhydride of 1-diazo-2-naphthol-4-sulphonic acid with  $\beta$ -naphthol, forming a dark powder of greenish metallic luster, easily soluble in cold water with a raspberry-red color turning into pure blue by the addition of ammonia, soluble in concentrated sulphuric acid with a dark blue shade, precipitated by concentrated hydrochloric acid from the alkaline solution in brownish violet flakes and yielding on wool in acetic acid bath brownish red shades, turning into blue black when treated after dyeing with chromium compounds and into a violet black with copper salts.

790,366. Karl Heintzel, Lüneburg, and Eduard Cramer, Berlin, Germany. **Improving gypsum mortar.** The method consists in adding to the gypsum mortar acid sulphates of the alkaline metals.

790,390. Edgar F. Price, Niagara Falls, N. Y. **Reducing metallic compounds.** Ores of metals whose temperatures of reduction and volatilization are approximately the same, like Si, Al, and Mn, are heated with a charge of the reducing agent, as

carbon, in an electric furnace in which the temperature is lower than that at which the metal would volatilize, removing the metal from the zone of maximum temperature as it is reduced, and collecting the scattered particles of reduced metal by introducing a metal, as iron, into the furnace and causing it to percolate down through the charge.

790,391. Same. **Smelting metallic compounds.** A process of smelting metallic compounds and producing metallic products containing a definite percentage of carbon by providing an electrically conductive charge containing a predetermined amount of carbon, establishing an electric arc within the charge, surrounding the zone of reduction and protecting the electrodes from the oxidizing and cooling effects of the atmosphere by a considerable body of the charge, and maintaining between the electrodes the minimum of difference of potential requisite to effect reduction.

790,392. Same. **Producing ferrochromium.** The process consists in smelting a charge containing carbon and combined iron and chromium by passing an electric current through the charge, acting as a resistance conductor, and separating and maintaining the alloy out of contact with the carbon in the charge by an intermediate layer of slag.

790,393-4. Same. **Smelting ores and producing ferrochromium.** Ores containing iron and an alloying metal are smelted so as to form an alloy containing a minimum or definite percentage of carbon, by interposing a charge of the ore and a predetermined amount of carbon as a resistance conductor between superposed electrodes, the lower electrode consisting of the alloy to be formed and comprising a liquid portion and a solid portion, electrically heating the charge to the temperature requisite for the reduction by an electric current, the density of which increases through the charge, cooling the solid portion of the alloy electrode, permitting the molten product to settle and collect upon the lower electrode, and removing the product and supplying fresh charge materials. The second is for metals in general.

790,395-6-7. Same. **Low-carbon metals or alloys.** At first a product relatively high in carbon is produced by smelting the charge with an excess of carbon; the high carbon product is subdivided and mixed with a decarburizing agent containing calcium, heating the mixture to a temperature sufficient to cause the carbon to unite with the calcium, with the production of calcium carbide, by passing an electric current through the mixture acting as a resistance conductor, and separating the carbide from the decarburized product. In the last the hot molten product percolates through the granular charge.



790,415. Oliver W. Zane, Los Angeles, Cal. Assignor by direct mesne assignments to John McCleod Armstrong, Longbeach, Cal. **Amalgamating-plate-plater and amalgamating plate-cleaning compound.** It consists of 30 parts dissolved potassium cyanide, 1 part of dissolved silver nitrate and dissolved soap bark, evaporated to a paste.

790,429. Adolph Gutensohn, Southbend, England. **Recovering metals and oxides from solutions.** Solutions of metals and oxides are mixed with a coagulant of resin, lime and sodium hydroxide, a solution of alkali and resin added and the coagulated mass rising to the surface of the liquid is withdrawn, the mixture separated and retorted to distil off the resin.

790,468. Henry V. Walker, Brooklyn, N. Y. **Fumigation.** An aqueous solution of formaldehyde is brought into contact with quicklime in the presence of an agent capable of preventing the production of formose, as aluminium sulphate and solution of the resulting calcium hydroxide.

790,469. Same. **Compound for fumigating.** The fumigating compound formed in the process described in 790,468, aluminium sulphate being specified as the agent to be mixed with the formaldehyde solution.

790,488. Carleton Ellis, New York, N. Y. Assignor to Eldred Process Co., New York, N. Y. **Generating combustible gas.** The process consists of passing through a mass of ignited fuel a current of air containing carbon dioxide, and varying at frequent intervals the quantity of carbon dioxide to produce a relatively low temperature at the time of addition of fresh fuel, and subsequently increasing the temperature to effect the gradual evolution of the products of distillation.

790,489. Same. **Manufacturing combustible gas.** The process consists of passing through a deep mass of ignited fuel a current composed alternately of heated and cooled products of combustion together with a predetermined amount of air or oxygen, and delivering the gas unburned to the place of consumption.

790,502. Frank M. Holmes, Marionville, Mo. Assignor to Richard H. Stevens, trustee, Clayton, Mo. **Battery solution.** Consists of an exciting fluid as sulphuric acid, and a solution of gum obtained from stone fruit trees as cherry gum, to prevent evaporation.

790,504. George F. Jaubert, Paris, France. **Oxygen from hypochlorites.** In the production of oxygen from hypochlorites a mixture of sulphate of iron and sulphate of copper is used as a catalytic agent.

790,565. Arthur Eichengrun and Theodor Becker, Elberfeld, Germany. Assignors to Farbenfabriken of Elberfeld Co., New

York, N. Y. **Triacetylcellulose.** A new triacetylcellulose characterized by its resistance to alkali carbonates, being a whitish voluminous mass readily soluble in chloroform, epichlorhydrin, nitrobenzene and glacial acetic acid, soluble in acetone and pyridine, and insoluble in alcohol, ether, acetic ether, amyl acetate and glycerol, not being attacked by cold alkaline carbonates, ammonia or dilute acids, leaving behind colorless, translucent, flexible films on evaporating its solutions, being precipitated upon pouring the solutions into water and being decomposed when heated to about 250°.

790,601. Karl Stephen and Paul Hunsalz, Berlin, Germany. Assignors to Chemische Fabrik auf Actien (vorm. E. Schering) Berlin, Germany. **Making camphor.** Isoborneol acetate is oxidized by chromic acid and the resulting camphor isolated.

790,647. Ernest C. Morgan, Richmond, England. **Self-toning photographic printing paper.** The plate or film is coated with an emulsion of first, sugar 36, citric acid 30, ammonium chloride 6.4, Rochelle salt 24 parts dissolved in 1200 parts starch solution, and to this mixture is added 750 parts of water holding 58 parts silver nitrate to 1 part of gold chloride and 1000 parts agar-agar solution, sp. gr. 1.10.

790,821. Henry V. Dunham, Bellows Falls, Vt. Assignor to Casein Co., of America. **Paint.** A paint composition containing 200 parts of a mineral base, as talc or whiting to 100 parts of a mixture of an alkali 1, casein 20, boric acid 2, formaldehyde 2.5, creosote 1, potassium oxalate 2, and water 200 parts. To this 50 parts of an equal mixture of vaselin and corn oil may be added.

790,840. Arthur Hough, Dover, N. J. **Nitrated carbohydrates.** The production of highly nitrated starch compound by subjecting starch to the action of nitric and sulphuric acids in such concentration as to produce a compound containing about 16.5 per cent. of nitrogen.

WM. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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## INORGANIC CHEMISTRY.

**The Atomic Weight of Thorium.** BY R. O. E. DAVIS. *J. Elisha Mitchell Sci. Soc.* 21, 45-56.—The author believes that the lack of uniformity in the various atomic weight determinations of thorium can be explained by the "Complexity of Thorium" (see Brauner and Baskerville, this Journal, 26, 922). With samples of pure thorium hydroxide, prepared by the citrate method, several ways of arriving at the atomic weight of thorium were tried, but without satisfactory results. The author finally chose the chloride method. The chloride was prepared as follows: A mixture of carbon (from rock-candy) and thorium oxide was placed in a carbon boat. This was put in a quartz-tube surrounded by a porcelain tube to protect it from the direct action of the flames of the furnace. When a stream of dry chlorine was conducted through the quartz tube heated to redness, a chloride was obtained which was used to determine the atomic weight of thorium. Weighed samples were dissolved in water, and the solutions were evaporated to dryness. The residue of oxide was ignited. From the weight of the oxide obtained, the atomic weight was calculated. The results were not concordant, but varied from 221-230. It was observed that the chloride which deposited in the quartz tube seemed to form in three separate fractions: (a) White volatile crystals ("weisser Dampf"); (b) crystals near the boat; (c) a less volatile portion in the boat. Each fraction was collected and purified. An analysis of each by the sulphate method gave the following values for the atomic weight:

	1.	2.	3.
a .....	213.6	212	.....
b .....	220.6	220.1	.....
c .....	255.5	255.9	255.6

The author thinks that these three chlorides are derived from distinct elements. He assigns the following names to the elements: (a) berzelium; (b) thorium; (c) carolinium. (Meyer and



Gumperz, who have repeated the experiments with a slight modification (*Ber.* 38, 817) reach, however, a different conclusion.)

LAUDER W. JONES.

**Cyanide of Potassium.** By F. J. H. MERRILL. *Science*, 22, 568.—While visiting the cyanide plant of Charles Butters, Limited, at Minas Priestas, Sonora, the author observed peculiar markings in a settling-tank charged with pulverized ore known as "slime," and filled with a solution of potassium cyanide. These markings were in the forms of holes or trails over the surface of the slime. The author thinks that they were undoubtedly caused by some small invertebrate. He did not have opportunity to make closer observations.

LAUDER W. JONES.

**The Effect of Water upon Rock Powders.** By ALLERTON S. CUSHMAN. *Bur. Chem., Bull.* 92.—As a result of many experiments to determine the best conditions for grinding rocks to increase their cementing value, the author arrives at the following conclusions: The effect of wet grinding is to increase the binding or cementing value of rock powders, and there are indications that the addition of a small amount of soluble electrolyte to the water will still further increase this value. When water comes into contact with most rock powders, an immediate reaction takes place, and the water assumes an alkaline reaction towards phenolphthalein, but this alkaline reaction is inhibited to a great extent, if the solid particles are filtered out. The microscope reveals an accumulation of amorphous material of a gummy nature largely associated with the surfaces of the crystalline particles. It is shown that the behavior of rock powders after the action of water is similar to that of coagulated colloids artificially prepared in the laboratory, and that the formation of colloids upon the surfaces of the particles would account for the increased binding power acquired under the influence of wet grinding. The wet grinding abrades the films of colloidal material, and presents fresh surfaces to the action of water. The term "pectoid" has been applied to these colloidal substances, which are stained by methylene blue just as ordinary colloids are.

LAUDER W. JONES.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**The Cobalt-Nickel Arsenides and Silver Deposits of Temiskaming.** By WILLET G. MILLER. *Rep. Bureau of Mines [Ontario]*, 1905, *Part II*, 66 pp.; maps, plates.—This is a more detailed report concerning these remarkable deposits than that already noticed in these pages (27, R 480). Unlike the nickel ores of Sudbury, which are generally recognized to be of igneous origin, those of Temiskaming appear to have been deposited

from highly heated waters representing the end product of diabase eruptions. With few exceptions in diabase and the Keewatin, the deposits "occupy narrow, practically vertical fissures or joints which cut through a series of usually slightly inclined metamorphosed rocks of Lower Huronian ages." Analyses of many of the ores and a few associated rocks are given, as well as of the following minerals: A mixture of annabergite and erythrite ("white bloom," a white clay-like material in which the green and pink colors of the two arsenates destroy each other), cloanthite, tetrahedrite, mispickel, native bismuth, calcite. Other Canadian and foreign occurrences of cobalt-nickel ores are compared.

W. F. HILLEBRAND.

**Petrography of the Amphibolite, Serpentine, and Associated Asbestos Deposits of Belvidere Mountain, Vermont.** BY VERNON F. MARSTERS. *Bull. Geol. Soc. Am.*, Vol. 16, pp. 419-446; map, plates.

W. F. HILLEBRAND.

**Description of Bradshaw Mountains [Arizona] Quadrangle.** BY T. A. JAGGAR, JR. AND CHARLES PALACHE.—This is the descriptive text of the *Bradshaw Mountains Folio, No. 126*, of the *Geologic Atlas of the U. S.*, issued by the Geological Survey. The report contains hitherto unpublished analyses by George Steiger of the following rocks: Diorite, in which the plagioclase has been entirely altered to zoisite, monzonite-porphyry, miarolitic trachydoleite, basaltic facies of trachydolerite, and partial analyses of hornblende-hypersthene-mica-andesite, typical basalt, diorite-porphyry and quartz-porphyry.

W. F. HILLEBRAND.

**Sixth Annual Report of the State Geologist [Michigan].** BY ALFRED C. LANE. *Rep. State Board of Geol. Survey of Michigan*, 1904, pp. 113-168; plate. Aside from a few analyses of peat, coal, and rocks from Mount Bohemia, there is little of a chemical nature in this report.

W. F. HILLEBRAND.

**The Differential Thermal Conductivities of Certain Schists.** BY PAUL THELEN. *Bull. Dept. Geol. Univ. California*, Vol. 4, pp. 201-226; plates.—The measurements seem to favor the conclusion that the thermal conductivity of the schist is simply the sum of the thermal conductivities of the constituent minerals.

E. C. SULLIVAN.

**Sketch of the Geology of Mineral King, California.** BY A. KNOPF AND P. THELEN. *Bull. Dept. Geol. Univ. California*, Vol. 4, pp. 227-262; plates.

E. C. SULLIVAN.

**Geology of the Northern Adirondack Region.** BY H. P. CUSHING. *New York State Museum, Bull.* 95, pp. 271-453.—Contains descriptive matter on rocks, discussion of metamorphism, and analyses. The latter have previously been published elsewhere.

E. C. SULLIVAN.

**The Phase Rule and Conceptions of Igneous Magmas—Their Bearing on Ore Deposition.** BY T. T. READ. *Economic Geology*, 1, 101 (1905).—After a brief exposition of the elements of the phase rule, the author undertakes to show that certain rocks may be considered as stable and others as unstable. He begins by assuming that the number of components in ordinary rocks may be considered as four, viz.,  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $(\text{Ca}, \text{Mg}, \text{Fe})\text{O}$  and  $(\text{K}_2, \text{Na}_2)\text{O}$ . It is assumed that  $\text{Fe}_2\text{O}_3$  may replace  $\text{Al}_2\text{O}_3$  without altering the complexity of the system, and water is excluded from consideration. From these assumptions, the author deduces the stability and instability of a number of rocks. Unfortunately, the fundamental assumptions are not true, consequently the deductions are not warranted. It is a fact appreciated by physical chemists that the various oxides above mentioned must be treated as individual components, and while mineralogists are wont to regard them as of equal value and mutually replaceable, they do not behave in this way when the rocks are considered from the standpoint of physical chemistry. The author illustrates his conceptions of the phase rule by discussing alloys of copper and tin, and here again his acquaintance with the subject seems rather superficial. To explain the difference in acidity between the first and last lavas ejected from a common source, the author suggests the idea of two liquid layers. Unfortunately, there are no cases known in which these mixtures of silicates form two liquid layers, and there seems to be no good ground for such an explanation. The author has purposely excluded water from consideration as a component. In the first place, we know that water must be considered as a component in lavas. It seemed unfortunate therefore to exclude it from consideration in a paper of this sort. It is also rather unfortunate that among the rocks which the author considers as stable, he classes glass as a phase which, if the rock is stable, must also be stable. Aside from repeating an old suggestion that the vapors from these lavas are a potent factor in ore deposition, the author scarcely mentions the subject. E. S. SHEPHERD.

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## ANALYTICAL CHEMISTRY.

**The Use of the Rotating Cathode for the Estimation of Cadmium Taken as the Chloride.** BY CHARLES P. FLORA. *Am. J. Sci.* 20, 392 (1905).—In a previous article, methods for the determination of cadmium as the sulphate were described. Some differences may be expected in the case of the chloride on account of the formation of complex cadmium-chlorine negative ions, and because the chlorine does not combine with the water present to



give oxygen at the anode but exists in the solution as free chlorine. Solutions containing sulphuric acid, cyanides, pyrophosphates and phosphates gave good results, although the cyanide solution must be handled with care to prevent foaming. The other solutions examined, *viz.*, those containing acetates, oxalates, urea, formaldehyde, acetaldehyde, formates and tartrates were practically useless, as the free chlorine acted upon the organic compounds, forming substances detrimental to the process.

R. C. SNOWDON.

**Electrolytic Determination of Zinc.** BY K. JENE. *Chem. Ztg.* 29, 803 (1905). *Eng. Min. J.* (Abstract) 80, 677 (1905).—The method described is an adaptation of the one devised by v. Foregger-Greifenturn. Details are given for the electrolytic determination of zinc from the sodium zincate solution. The zinc is obtained from the substance as the sulphate and is changed to the zincate by the addition of sodium hydroxide. The solution is then electrolyzed at 50° C. in a coppered platinum or a nickel dish and the deposit is washed with water and alcohol before weighing. Duplicate determinations agree very closely, and the maximum difference between a large number of results obtained by this method and the gravimetric was 0.3 per cent. Iron, aluminum and manganese do not interfere with the electrolysis.

R. C. SNOWDON.

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## ORGANIC CHEMISTRY.

**Bromine Addition Compounds of Dimethylaniline.** BY C. LORING JACKSON AND LATHAM CLARKE. *Am. Ch. J.* 34, 261-290.—*Benz-3,4-dibromide of Dimethylaniline*,  $\text{Br}_2\text{C}_6\text{H}_3\text{N}(\text{CH}_3)_2$ , from dimethylaniline and bromine, in chloroform solution, crystallizes from chloroform in yellowish plates or needles, melting with decomposition at about 82°. The compound is soluble in methyl or ethyl alcohols, chloroform or acetone; essentially insoluble in ether, benzene, toluene, ligroin, acetic ester or carbon tetrachloride. It dissolves also in hydrochloric acid, in dilute nitric or dilute sulphuric acids. Strong nitric acid dissolves it easily, but the solution soon decomposes. Strong sulphuric acid dissolves it with evolution of hydrogen bromide. It is decomposed slowly in the air, very quickly by water, and almost instantly by aqueous or alcoholic potassium hydroxide solutions, ammonia or aniline, with elimination of hydrogen bromide and formation of *p*-bromdimethylaniline. It adds bromine easily, does not liberate iodine from potassium iodide solutions, gives a reddish brown color with quinone, and with potassium iodide and sodium thiosulphate yields *p*-bromdimethylaniline. *Benz-3,4-dibromide*

of *Dimethylethylphenylammonium Bromide*,  $\text{Br}_2\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2\text{C}_2\text{H}_5\text{Br}$ , from the above benzdibromide and ethyl bromide, crystallizes in white, flat prisms, which are changed to a red oil by the addition of water. *Benz-3,4-dibromide of Dimethylphenylamine Dibromide*,  $\text{Br}_2\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2\text{Br}_2$ , from dimethylaniline, or its benzdibromide, and bromine, in chloroform solution, the temperature of the solution being allowed to rise somewhat towards the latter part of the reaction, forms long, yellowish red needles, melting at about  $68^\circ$ . The substance is soluble in methyl or ethyl alcohols, chloroform, acetone or ethyl acetate; somewhat soluble in carbon tetrachloride; essentially insoluble in benzene, toluene or ligroin. All of these solvents, except chloroform and carbon tetrachloride, react with the compound in the cold. It is insoluble in dilute mineral acids, and decomposed by them when concentrated. Aqueous or alcoholic potassium hydroxide solutions convert it into dibromdimethylaniline. Acetone apparently changes it to the benzdibromide of dimethylaniline; alcohol, to the hydrobromide of dibromdimethylaniline; with cold chloroform, a reddish black perbromide results, while with boiling chloroform a viscous substance is formed, which is probably the benzdibromide of dimethylbromphenylamine hydrobromide. *Dibromdimethylaniline*,  $\text{C}_6\text{H}_3\text{Br}_2\text{N}(\text{CH}_3)_2$ , as obtained from the benz-3,4-dibromide of dimethylphenylamine dibromide, boils at  $264^\circ$  at 760 mm., and is a colorless oily liquid, which mixes with methyl or ethyl alcohols, ether, benzene, toluene, chloroform, acetone, or ethyl acetate, but not with water. It is soluble in moderately strong acids, takes up bromine directly, and forms substituted ammonium salts with methyl iodide or ethyl bromide. Its *hydrobromide* forms colorless crystals, m. p.  $110^\circ$ , which change at  $140^\circ$  to a blue coloring-matter. It is dissociated by water. *Benztetra bromide of Dimethylphenylamine Dibromide*,  $\text{Br}_4\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2\text{Br}_2$ , was also obtained as a product of the action of bromine upon dimethylaniline in chloroform solution, or of bromine upon the corresponding benzdibromide of dimethylphenylamine dibromide. It forms reddish needles, which readily lose hydrogen bromide and give the next compound. *Benzdibromide of Dimethyl-p-Bromphenylamine Dibromide*,  $\text{Br}_2\text{C}_6\text{H}_4\text{BrN}(\text{CH}_3)_2\text{Br}_2$ , forms large reddish prisms or small yellow crystals, melting at about  $78^\circ$ , which slowly darken in the air. It turns black when heated with water. It is dissolved apparently without change by strong hydrochloric acid. Its solution in strong nitric acid soon decomposes, while strong sulphuric acid decomposes it immediately. Aqueous or alcoholic potassium hydroxide solutions convert it into dibromdimethylaniline. Acetone reacts violently with it, giving dibromdimethylaniline hydrobromide. If the acetone is diluted with chloroform, the reaction is somewhat different, the product being the benzdibromide of bromdimethylaniline,  $\text{Br}_2\text{C}_6\text{H}_4\text{BrN}(\text{CH}_3)_2$ . Alcohol also changes it to the dibromdimethylaniline

hydrobromide, unless the amount of alcohol used is small, and the temperature remains below  $50^{\circ}$ , when a *perbromide*,  $(C_6H_3Br_2N(CH_3)_2HBr)_2Br$ , is formed. The same *perbromide* appeared to be formed when the substance stood for some time in the air, or when it was treated, under proper conditions, with water, ligroin or toluene; it separated from the solution in glistening black plates or prisms. The benzdibromide of dimethylbromophenylamine dibromide reacts with aniline to form dibromdimethylaniline and aniline hydrobromide; with potassium iodide and sodium thiosulphate, to give *p*-bromdimethylaniline and dibromdimethylaniline; with potassium iodide in presence of chloroform, to give a *compound*,  $C_6H_3Br_2N(CH_3)_2NBrI$ , crystallizing in reddish yellow flat prisms, m. p.  $137^{\circ}$ ; and with sodium acetate in glacial acetic acid solution, to give dibromdimethylaniline. The Addition of Bromine to *p*-Bromdimethylaniline gave usually the *perbromide*,  $C_6H_3Br_2N(CH_3)_2HBr_3$ . The benzdibromide of *p*-bromdimethylaniline, obtained as described above, is an oil which gradually changes to the dibromdimethylaniline hydrobromide. The Addition of Bromine to Dibromdimethylaniline resulted in the formation of what was probably the *tetra-perbromide*,  $C_6H_3Br_2N(CH_3)_2HBr_4$ , which crystallized in small, yellowish red flat prisms, m. p.  $98^{\circ}$ . With potassium iodide and sodium thiosulphate, it gave tribrommethylaniline; with sulphuric acid, hydrogen bromide; with boiling alcohol or chloroform, *tribrommethylaniline hydrobromide*. The latter forms cubical crystals, which turn brown at  $200^{\circ}$ , and melt at  $202^{\circ}$ . It is dissociated by water. *p*-Bromphenyldimethylamine Diiodide,  $C_6H_4BrN(CH_3)_2I_2$ , from *p*-bromdimethylaniline and iodine, in chloroform solution, forms flat black prisms, m. p.  $115^{\circ}$ ; slightly soluble in alcohol, acetone or ethyl acetate, giving green solutions; insoluble in benzene, toluene, ligroin, or carbon tetrachloride.

M. T. BOGERT.

**On Certain Derivatives of Tetrabrom-*o*-Benzoquinone.** By C. LORING JACKSON AND H. A. CARLTON. *Am. Ch. J.* **34**, 422-441.—The paper deals with the action of alcohols on tetrabrom-*o*-benzoquinone,  $C_6Br_4O_2$ . When the quinone and methyl alcohol are allowed to stand together at ordinary temperatures, *Methyl Alcohol Tetrakis-tetrabrom-*o*-benzoquinone*,  $(C_6Br_4O_2)_4CH_3OH$ , is formed at first. It is a union of two molecules of tetrabrom-*o*-benzoquinone with one of the  $\alpha$ -body,  $(C_6Br_4O_2)_2CH_3OH$ . It crystallizes in small, transparent, cherry-red prisms, which melt at  $194-195^{\circ}$  when heated quickly, and are soluble in alcohol or benzene. Long contact with methyl alcohol gradually changes it into the  $\alpha$ -compound of the quinone and methyl alcohol, while warming with dilute sodium hydroxide solution converts it into the corresponding  $\beta$ -compound,  $(C_6Br_4O_2)_2CH_3OH$ . The latter separates from benzene in white crystals, m. p.  $259-260^{\circ}$ , and is



also formed when the  $\alpha$ -compound is warmed with dilute sodium hydroxide solution. The  $\alpha$ -benzyl alcohol compound was similarly changed to the  $\beta$ -form.  $\alpha$ -Ethyl Alcohol Tetrabrom-*o*-benzoquinone,  $(C_6Br_4O_2)_2C_2H_5OH$ , crystallizes from benzene and alcohol in minute white crystals, m. p.  $180-185^\circ$ .  $\beta$ -Ethyl Alcohol Tetrabrom-*o*-benzoquinone,  $(C_6Br_4O_2)_2C_2H_5OH$ , crystallizes in small, white, rhombic plates, m. p.  $228^\circ$ .  $\alpha$ -*n*-Propyl Alcohol Tetrabrom-*o*-benzoquinone; small, transparent, light yellow prisms, m. p.  $180^\circ$ .  $\beta$ -Form; small, white, six-sided plates, m. p.  $176^\circ$ .  $\alpha$ -*i*-Amyl Alcohol Tetrabrom-*o*-benzoquinone; bright-yellow prisms, m. p.  $150^\circ$ .  $\beta$ -Form; small, white prisms, m. p.  $177^\circ$ . Reduction of  $\alpha$ -Bodies. By reducing with zinc and acetic acid, the  $\alpha$ -addition products of the quinone and water, methyl or benzyl alcohols, or the red methyl alcohol compound,  $(C_6Br_4O_2)_4CH_3OH$ , one and the same final product resulted in every case,  $C_{18}Br_8O_6H_4$ , which the authors designate provisionally as octobromdihydroxyhemipyrocatechinepyrocatechine ether,  $C_6Br_4 : O_2 : C_6H(OH)_2O.C_6Br_4OH$ . It crystallizes from benzene in small, light-brown, silky prisms, m. p.  $274-275^\circ$ . Diacetyl derivative; small prisms, brownish or yellowish white, m. p.  $304-305^\circ$ , not attacked by strong acids or by sodium hydroxide solution; triacetyl derivative, m. p.  $273-275^\circ$ ; tribenzoyl derivative, m. p.  $250-255^\circ$ . By the action of nitric acid, a product was obtained consisting of two substances, one crystallizing in red prisms, and melting at about  $275-280^\circ$ , the other in yellow needles, not melting at  $310^\circ$ .  $\beta$ -Acetbenzyl Alcohol Tetrabrom-*o*-benzoquinone,  $(C_6Br_4O_2)_2C_7H_7OCOCH_3$ , from the  $\beta$ -benzyl alcohol compound, sodium acetate and acetic anhydride, crystallizes from a mixture of benzene and methyl alcohol in small, white needles, m. p.  $210^\circ$ , and is unaffected by the strong acids or by sodium hydroxide solution.

M. T. BOGERT.

**Addition-Compounds of Quinones and Tertiary Amines.** By C. LORING JACKSON AND LATHAM CLARKE. *Am. Ch. J.* **34**, 441-459.—Quinones unite with tertiary amines to unstable colored compounds, composed of one molecule of the quinone to one of the amine. In general, when the quinone contains not more than one atom of halogen, the addition-products are red; when there are two or more halogens, the color is blue or purple. EXPERIMENTAL.—Tetrabrom-*o*-benzoquinone and Dimethylaniline,  $C_6Br_4O_2.C_6H_5N(CH_3)_2$ ; fine, glistening, purple needles, very unstable. Chloranil and Dimethylaniline; slender, deep-blue prisms, with bronze lustre, which melt at  $105^\circ$ , and are very unstable. Trichlor-*p*-benzoquinone and Dimethylaniline; beautiful, slender, dark-blue prisms, with bronze lustre, which melt at  $65^\circ$ , and rapidly decompose. 2,5-Dichlor-*p*-benzoquinone and Dimethylaniline; slender, deep-blue needles, which are very unstable. Bromanil and Dimethylaniline; fine, purple needles, m. p.  $65-68^\circ$ . Trichlortoluquinone and Dimethylaniline; purple crystals, m. p.

68–73°. Many other quinones gave color reactions with dimethylaniline, but the products were too unstable to be isolated. *Chloranil* and *Dimethyl-p-toluidine*; blue crystals, m. p. 114°, which give a violet powder, and change in the air to a green wax. *Trichlorquinone* and *Dimethyl-p-toluidine*; long, blue needles. *Trichlortoluquinone* and *Dimethyl-p-toluidine*; fine, deep-blue needles, m. p. 74–76°. *Bromanil* and *Dimethyl-p-toluidine*; pale blue crystals, m. p. 109°. *Trichlorquinone* and *Dimethylbenzylamine*; red, microscopic crystals. *Trichlorquinone* and *Dimethyl-isoamylamine*; red crystals, which changed to a red wax in a few seconds. *Trichlorquinone* and *Dimethyl-α-naphthylamine*; blue-black, lustrous crystals. *Trichlorquinone* and *Diethyl-α-naphthylamine*; blue needles. *Trichlorquinone* and *Diethyl-β-naphthylamine*; sharp needles, black by reflected, green by transmitted light. *Bromanil* and *Diethyl-β-naphthylamine*; black, lustrous prisms. *Trichlortoluquinone* and *Diethyl-β-naphthylamine*; long slender, blue-black needles. *Quinone* and *α-Naphthylamine*; brownish red needles, comparatively stable. *Trichlortoluquinone* and *α-Naphthylamine*; deep-blue crystals, comparatively stable. *Chloranil* and *Diphenylamine*; black crystals, very unstable. *Trichlorquinone* and *Diphenylamine*; black crystals, very unstable. *Chloranil* and *Pyridine*; brownish red plates, unstable. *Quinone* and *Tetramethyldiaminotriphenylmethane*; flat, purplish violet prisms. Many other quinones and amines gave color reactions, but the addition-products were too unstable to be separated in crystalline condition.

M. T. BOGERT.

**The Action of Methyl Alcohol on Hexabrom-*o*-Quinopyrocatechin Ether.** BY C. LORING JACKSON AND P. A. SHAFFER. *Am. Ch. J.* 34, 460–467.—Jackson and his co-workers have already shown that tetrabrom-*o*-benzoquinone forms three compounds with methyl alcohol, two isomers ( $\alpha$ - and  $\beta$ -) of the formula  $(C_6Br_4O_2)_2CH_3OH$ , and a compound,  $(C_6Br_4O_2)_4CH_3OH$ . As hexabrom-*o*-quinopyrocatechol ether,  $C_6Br_4O_2 \cdot C_6Br_2O_2$ , may be regarded as a tetrabrom-*o*-benzoquinone with two of its bromine atoms replaced by the catechol residue, the authors examined its behavior also with methyl alcohol, and, in presence of sodium methylate, discovered that the ether combined with methyl alcohol to a compound,  $C_{12}Br_6O_4 \cdot CH_3OH \cdot CH_3ONa$ , which yielded with acids the body  $C_{12}Br_6O_4(CH_3OH)_2$ . **EXPERIMENTAL.**—*Methyl Alcohol Hexabrom-*o*-quinopyrocatechol Ether.* Hexabrom-*o*-quinopyrocatechol ether was suspended in methyl alcohol, dissolved by the careful addition of sodium methylate, the solution acidified slowly with hydrochloric or sulphuric acid, diluted with methyl alcohol, boiled, filtered, and the filtrate cooled with ice water, when the methyl alcohol addition-product crystallized out. It crystallizes from alcohol in white rhombic plates, melting with decomposition at 220–221°. The amount of sodium methyl-

ate necessary to add to the methyl alcohol in order to dissolve the original ether corresponded almost exactly to the formation of a salt,  $C_{12}Br_6O_4 \cdot CH_3OH \cdot CH_3ONa$ , but it was not found possible to isolate this salt. The methyl alcohol addition-product,  $C_{12}Br_6O_4(CH_3OH)_2$ , when boiled with 20 per cent. sodium hydroxide solution, gave red needles, which decomposed at about  $280^\circ$  without melting. Various reactions are recorded for the hexabrom-*o*-quinopyrocatechol ether, and several unidentified products were obtained. Phenylhydrazine, diluted with nitrobenzene, reduced it to hexabromodihydroxypyrocatechol ether,  $C_6Br_4O_2 \cdot C_6Br_2(OH)_2$ , and this is the most convenient method of preparing the latter substance yet discovered.

M. T. BOGERT.

**Phenylisoxazolone.** BY ALFRED TINGLE. *Am. Ch. J.* **34**, 471-472.—Posner has recently described the preparation of phenylisoxazolone from  $\beta$ -oxamino- $\beta$ -phenylpropionic acid. His attention is now called to the fact that this isoxazolone was first prepared by Claisen and Zedel, by the action of hydroxylamine on ethyl benzoylacetate, and, subsequently, by Tingle, from hydroxylamine and ethyl cinnamate. Tingle also states that he hopes to resume the study of this compound later.

M. T. BOGERT.

**On Rosocyanin** (Preliminary Communication). BY C. LORING JACKSON AND LATHAM CLARKE. *Ber.* **38**, 2711-2712.—The usual test for boric acid rests upon the formation of a red substance which Schlumberger has called "rosocyanin," and which is produced by the action of boric and sulphuric acids upon curcumin. The authors prepared rosocyanin by heating a mixture of 0.5 gram curcumin, 0.5 gram boric acid, 0.5 gram sulphuric acid, 10 cc. of water and 10 cc. of alcohol, upon the water-bath, and purifying the product. The rosocyanin thus obtained was a purplish red substance, resembling pulverized rosaniline, but with a rather more yellowish green metallic lustre. The alcoholic solution was a beautiful rose-red. The salts are intense blue. Analyses and molecular weight determinations established the formula  $C_{14}H_{14}O_4$ , which is isomeric with that of curcumin. Apparently the conversion of curcumin into rosocyanin is due to the conversion of a hydroxyl into oxide oxygen and hydrogen. *Ammonium Salt*,  $C_{14}H_{13}O_4 \cdot NH_4$ ; blue precipitate. *Potassium Salt*,  $C_{14}H_{13}O_4K$ . Rosocyanin is monobasic.

M. T. BOGERT.

**On the Formula of Curcumin** (Preliminary Communication). BY C. LORING JACKSON AND LATHAM CLARKE. *Ber.* **38**, 2712-2713.—Two formulas have been proposed for curcumin,  $C_{14}H_{14}O_4$  and  $C_{21}H_{20}O_6$ . From a determination of the molecular weight of curcumin, and a comparison of curcumin and rosocyanin, the authors believe the formula  $C_{14}H_{14}O_4$  to be preferable.

M. T. BOGERT.



## BIOLOGICAL CHEMISTRY.

**The Physiology of Cell-Division. I. Experiments on the Conditions Determining the Distribution of Chromatic Matter in Mitosis.** BY RALPH S. LILLIE. *Am. J. Physiol.* **15**, 46-85.—The disposition and relative positions of many colloid aggregates in the cell, especially the chromosomes and chromatic filaments during mitosis, indicate that mutual electrostatic attractions and repulsions play an important part in determining their position and movements. By the use of mutually repellent groups of floating magnetized needles exposed to the attractive or repellent action of magnetic poles, many features in the above arrangements can be simulated, particularly spireme figures and the arrangement of the chromosomes in equatorial plates of normal and tripolar mitoses. The conditions necessary for the simulation of equatorial plate formations indicate that the astral centres have a repellent action on the chromosomes, and therefore, since chromosomes are negatively charged aggregates, these areas must also be negatively charged. The corresponding positive charges are apparently situated in the interastral area and toward the surface of the cell. F. P. UNDERHILL.

**On Resistance to Lack of Oxygen and On a Method of Increasing this Resistance.** BY WALES H. PACKARD. *Am. J. Physiol.* **15**, 30-42.—Increasing the alkalinity of the blood of *Fundulus heterochitis* by the injection of three to eight drops of 5/16 M solution of sodium bicarbonate increases their power of resistance to lack of oxygen. Decreasing the alkalinity of the blood by the injection of M/250—M/500 solution of acetic acid decreases their power of resistance. Increasing the levulose content of the blood seems to have no effect on the power of resistance to lack of oxygen. F. P. UNDERHILL.

**The Physiology of the Digestive Tract of Elasmobranchs.** BY M. X. SULLIVAN. *Am. J. Physiol.* **15**, 42-46.—Extracts of buccal mucus have no digestive action on starch, fibrin or fat. The reaction of the esophagus is often acid, and its extracts have no digestive power. The glycerol hydrochloric acid extracts of the stomach digest fibrin with the formation of acid proteid, proteoses and peptones. Extracts of the duodenum have no digestive power, nor do extracts of the spiral valve. Extracts of the pancreas vary in their action. Some have no digestive action whatever. Neither water extracts nor sodium carbonate extracts of the pancreas of the various elasmobranchs have any digestive action on hard-boiled egg or fibrin. Extracts of the middle intestine do not activate the pancreas. Bile activates the pancreas extracts slightly. Boric acid extracts plus boric acid extracts of the spleen of a fish in full digestion gave the

greatest digestion of fibrin. Leucine and tyrosine were found in the spiral valve. Fresh pancreas emulsifies oil. No extract obtained had amylolytic activity. Glycerol acetic acid extracts of *Mustelus canis* convert starch to sugar. Chitin is not acted upon by gastric juice.

F. P. UNDERHILL.

**Relation of Kreatinin Excretion to Variations in Diet.** By WALDEMAR KOCH. *Am. J. Physiol.* 15, 15-30.—Kreatinine is excreted with remarkable constancy by the dog as well as by man. The extreme daily variations in the case of the dog do not affect the final average. The excretion per kilo body-weight for twenty-fours is very nearly the same for both (24-26 mg. for the dog, 26-30 mg. for man). Under ordinary conditions of diet, the methyl groups of the lecithin and kephalin ingested can all be accounted for by the methyl groups of the kreatinine excreted. With an excess of lecithin and kephalin this is not the case, although the kreatinine is undoubtedly increased. This increase is due to the lecithin and kephalin of the egg, and not to some other constituent. Kreatinine is probably a better index of methyl metabolism than of the lecithin and kephalin metabolized, although under ordinary conditions the two seem closely related. Further experiments will have to determine whether physiological activity is capable of influencing this metabolism to a greater extent than the presence of an excess of methyl groups in the form of lecithin and kephalin. If kreatinine bears the relation to methyl metabolism suggested above, it should be possible to demonstrate the presence of kreatine in every tissue having such a metabolism. The presence of kreatine in striated muscle is a well-known fact. Koch has also found it in the heart muscle and in the testicle, and is continuing the investigation of other tissues.

F. P. UNDERHILL.

**A Pharmacological Study of Anesthetics and Narcotics.** By ORVILLE HARRY BROWN. *Am. J. Physiol.* 15, 85-98.—Anesthetics and narcotics at certain concentrations cause profound changes in the eggs of starfish. This change appears to be a partial liquefaction. The power of the compounds in bringing this about is indicative of their power as narcotics, that is, the narcotic substance which produces liquefaction of the eggs in a dilute solution will also, in small amounts, produce narcosis. The relative narcotic or anesthetizing power of sixteen compounds is given. The anesthetics and narcotics do not cause the liquefaction if they are sufficiently concentrated or sufficiently diluted. The concentrated solutions cause a change which has the appearance of a coagulation. The most important rôle of the lipoids in bringing about anesthesia probably is one of accumulation. If they are concerned with the essential processes of the cell, then their part is most likely a broader one. Anes-

thesia is very possibly the result of an inhibition by the compounds, of the enzymotic processes of the cell, as suggested by Neilson and Terry. Mathews' idea that the anesthetics produce their results by their influence upon the respiratory elements—the bivalent carbon compound—of the cell is a tenable one. Nef's bivalent carbon hypothesis may help to explain the more rapid narcosis when the temperature is slightly raised.

F. P. UNDERHILL.

**Cytotoxic Serum Produced by the Injections of Nucleoproteids.** BY S. P. BEEBE. *J. Exp. Med.* 7, 1-19.—In this paper it is shown that by the use of nucleoproteids cytotoxic sera may be obtained which are more or less specific for the organ or gland from which the nucleoproteid was derived.

F. P. UNDERHILL.

**The Herter Lectures. Lecture 2. The Contributions of Pharmacology to Physiology.** BY HANS MEYER. *Bull. Johns Hopkins Hosp.* 16, 389-394.

F. P. UNDERHILL.

**The Value of Meat Inspection to the Public Health.** BY D. ARTHUR HUGHES. *N. Y. Med. J.* 82, 1213-1217.—In this article are discussed the dangers of animal disease to the public health and methods of meeting the danger, together with what adequate meat inspection assures to the people.

F. P. UNDERHILL.

**Experimental Production of Glycuronic Acid in Dogs.** BY A. E. AUSTIN. *J. Med. Research.* 14 (New Series 9), 181-193.—The glycuronate in the urine remains the same whether glucose or lactose is given. Upon giving thymol alone the glycuronate is increased to nearly three times its former amount, while not appreciably increased by the subsequent addition of glucose or lactose to the food. Hence, there is apparently a limit to the amount of glycuronic acid that can be drawn from the body. Ethereal sulphate excretion keeps pace with that of glycuronate. There is no evidence that surcharging the body with carbohydrate tends to increase the elimination of glycuronic acid.

F. P. UNDERHILL.

**Synthetic Culture Media and the Biochemistry of Bacterial Pigments.** BY M. X. SULLIVAN. *J. Med. Research.* 14 (New Series 9), 109-161.—The view cannot longer be held that a sharp line of demarcation exists between chlorophyll-containing plants and those devoid of chlorophyll, since bacteria, like the higher plants, can build up their protoplasm and albuminous products, and their complex pigments, from very simple solutions. The blue-green pyocyanin is formed whenever there is present a suitable combination of carbon, hydrogen, oxygen and nitrogen, and some salt or salts to aid the synthesis or polymerization. The production of pyocyanin is independent of the presence of



either a phosphate or a sulphate. For the formation of the fluorescent pigment the presence of both sulphur and phosphorus is essential. The nature of the base associated with the sulphur and phosphorus is not important. The pyocyanin and fluorescent functions are closely related, since, according to the medium in which it is grown, one and the same variety of *B. pyocyaneus* can be made to produce pyocyanin alone, pyocyanin and a fluorescent pigment, or a fluorescent pigment alone. The purely fluorescent bacteria cannot be made to take up the pyocyanin function. Bacteria producing pyocyanin alone cannot be made to take up the fluorescent function. The fluorescent pigment formed by some varieties of *B. pyocyaneus* is produced under the same conditions as the fluorescent pigments in general. The production of the fluorescent pigment is favored by a high phosphate content and a slightly alkaline reaction. The production of pyocyanin is favored by a low phosphate content and a slightly acid reaction. The red pigments produced by *B. prodigiosus*, *B. rosaceus metalloides*, *B. ruber balticus*, and the violet pigments of *B. violaceus* and *B. janthinus* require the presence of magnesium sulphate and a phosphate, preferably potassium phosphate. The rose-red pigment of *M. roseus* and *M. mycoides roseus*, and the black pigment of *B. cyaneo-fluorescens* are produced in the presence of lactic acid. The yellow pigments produced by *B. fuscus*, *M. aurantiaca*, *M. citreus*, *M. tetragenus versatilis*, *S. lutea*, and *M. cereus flavus*, the red pigments of *B. levanianensis* and *M. agilis* are formed very slowly in non-albuminous media. These pigments are quickly formed in a peptone solution plus salts. As the peptone cannot be purified, little can be said of the physiological value of these salts. The presence of magnesium sulphate and dipotassium phosphate favors the production of these pigments. Of the organic salts of ammonium, the malate, tartrate and oxalate in percentages not greater than four-tenths per cent. allowed growth but no pigment. The formate and acetate gave no pigment in any percentages. The lactate, citrate, and succinate favored a good production of pigment. The salts which favor the production of pigment are necessary, not to render the solution isosmotic, but either as direct nutriment for the bacteria or to fix the acids produced, which otherwise would have a toxic effect upon the bacteria, or to afford material for chemical synthesis. The formation of pigment is dependent also upon the reaction of the media, suitable ranges of temperature, and the free access of oxygen. Abnormal temperature, acid or alkaline media, and lack of oxygen lead to a colorless growth. Besides the pigments and albumen-like bodies the chromogenic bacteria form acids and ammonia. These products apparently arise from the breaking up of asparagine or sugar and are independent pigment formation. The production of pigment is not an essential

vital act. As it is of no discoverable advantage to the organism possessing the power of producing it, its production is purely incidental.

F. P. UNDERHILL.

**Some Micro-Chemical Reactions and Their Value in the Study of Cancer Cells. First Paper—Iron.** BY MARTHA TRACY. *J. Med. Research.* 14 (New Series 9), 1-13.—The observations reported indicate that inorganic and albuminate iron are found only in areas of extravasated blood. That nuclear or organic iron occurs in the nuclei of epithelial cells in a distinct network, presumably in the chromatin; in leucocytes, and connective tissue cells, however, in such form as to cause a more diffuse and deeper nuclear stain. Whether such iron is in true organic combination in the nucleoproteids, or whether it is merely held firmly by action of the affinity which these proteids seem to have for it and other metals, probably cannot be proved by micro-chemical methods. A comparison of the reaction of tumor cells, whether epithelial or embryonal, or adult connective tissue, with the normal cells, the prototypes of these, shows no difference in the amount and distribution of iron contained therein.

F. P. UNDERHILL.

**On the Structure and Biology of the Yeast Plant (*Saccharomyces Cerevisiae*).** BY FRED MUTCHLER. *J. Med. Research.* 14 (New Series 9), 13-51.—The form of *Saccharomyces cerevisiae*, having remained constant under imposed conditions, leads to the conclusion that it is not a variable species. Any variation in form is due to the inherent nature of the cell rather than to external conditions. Variation in the size and rate of growth of cells is readily produced by changes in the conditions under which they grow. Anesthetics do not permanently destroy growth or reproduction of this species.

F. P. UNDERHILL.

**The Action of Glycerin on Bacteria in the Presence of Cell Exudates.** BY J. J. KINYOUN. *J. Expt. Med.* 7, 725-733.—It is shown in this article that glycerol has the property of destroying certain bacteria. Certain bacteria in pure culture are destroyed more slowly by glycerol than in vaccine and tissue emulsions. When normal serum and glycerol are permitted to act upon these bacteria, the destruction of the latter is brought about more quickly than by either fluid alone, and when immune sera are used instead of normal sera the destruction of bacteria is not so marked.

F. P. UNDERHILL.

**The Presence in the Bone-Marrow of Enzymes Resembling Those of Leucocytes.** BY EUGENE L. OPIE. *J. Expt. Med.* 7, 759-764.—These experiments demonstrate that the bone-marrow contains proteolytic enzymes which are more active than those of the spleen, lymphatic glands, liver, and kidneys. Unlike the

enzymes of these organs, those of the bone-marrow act more efficiently in an alkaline than in an acid medium, and in this respect resemble the proteolytic ferments contained in the leucocytes of an inflammatory exudate. Since the cells of such exudates, especially when obtained within twenty-four hours after the injection of an inflammatory irritant, are almost wholly polynuclear leucocytes with fine granulation, there can be but little doubt that the enzymes which they contain are identical with those demonstrable in the bone-marrow. Since morphological studies have demonstrated that leucocytes of this type are formed in the bone-marrow, this organ may be regarded as the source of the enzyme which both contain.

F. P. UNDERHILL.

**Studies upon Calcareous Degeneration. 1. The Process of Pathological Calcification.** BY OSKAR KLOTZ. *J. Exptl. Med.* **7**, 633-676.—It is shown that bone formation and pathological calcareous infiltration are wholly distinct processes. In the former there is no evidence of associated fatty change, and the cells associated with the deposition of calcium are functionally active. In the latter there is an antecedent fatty change in the affected areas, and the cells involved present constant evidences of degeneration. Besides the fact that calcification is always preceded by fatty change within the cells, another fact should be emphasized, namely, that combination of the fats present with calcium salts to form calcium soaps tends to occur. In areas undergoing calcareous infiltration, Klotz has demonstrated the presence of soaps, and this often in such quantities that they can be isolated and estimated by gross chemical methods. By microchemical methods it has been shown that after removing all the neutral fats and fatty acids by petroleum ether, there remains behind a substance giving with Sudan III the reaction associated with the presence of soap. Experimentally, these soaps have been produced within the organism by placing capsules containing fats and fatty acids within the tissues, and after several days finding that the capsules contain calcium soaps and possess a calcium content far in excess of that of the normal blood and lymph. In old areas of calcification, soaps are largely if not entirely wanting, although these are to be detected at the periphery when the process is still advancing. The reactions given by these older areas are almost entirely those of calcium phosphate, though some calcium carbonate is at times to be made out. This seems to indicate that the final stage in calcification is an interaction between the calcium soap albuminates and substances containing phosphoric and carbonic acid. Such substances are present in considerable amounts in the blood and lymph.

F. P. UNDERHILL.

**Centrifugal Urinary Analysis.** BY A. L. BENEDICT. *Med.*



*News.* 87, 1177-1181.—In the centrifugal analysis, considerable centrifugal force should be employed, to insure even and dense packing of precipitates. A speed of at least 2000 revolutions per minute is necessary. The inaccuracies of the centrifugal method depend, to a considerable degree, upon inaccurate graduation of tubes. Fairly accurate estimates of chlorides may be made by counting each percentage in bulk precipitate as 0.02 per cent. of sodium chloride. The same holds true of sulphates if one counts each percentage of bulk precipitate as 0.02 per cent. of  $\text{SO}_3$ .  $\text{P}_2\text{O}_5$  is estimated in a similar manner. If the precipitate reaches to 10 per cent. or over, the reading should be controlled with a diluted specimen. The uric acid determination by centrifuge is much less liable to experimental blunders than the Hopkins and allied chemical methods, but is subject to fallacies of unknown cause, or it includes with uric acid, other substances, probably basic purines. Each percentage of silver sludge corresponds, according to Dr. Cook, to 11.76 mg. of uric acid per 100 cc.

F. P. UNDERHILL.

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## AGRICULTURAL CHEMISTRY.

**Condimental Stock and Poultry Foods.** BY J. B. LINDSAY. *Mass. Hatch Expt. Sta., Bull.* 106.—This bulletin contains the chemical and microscopical analyses of 65 brands of stock and poultry foods. Tables are given showing the ordinary "fodder analysis;" the salt content of ash, the percentage of insoluble ash, the basic ingredients and other ingredients as determined by the microscope, the size of the package and the cost per pound. The poultry foods are high in ash, due to the presence of from 10-50 per cent. of ground oyster shells, or bone. The condition powders may contain fenugreek, fennel, aniseed, gentian, ginger, pepper, salt, sodium and magnesium sulphates, saltpeter, sodium bicarbonate, sulphur, iron oxide, charcoal or turmeric. The cost of all these individual substances is given. J. A. LECLERC.

**Distillers' Dried Grains vs. Cottonseed Meal as a Source of Protein.** BY H. P. ARMSBY AND A. K. RISSER. *Penn. State Coll. Expt. Sta., Bull.* 73.—The analyses of 56 samples of grains gave an average of 7.4 per cent.  $\text{H}_2\text{O}$ , 31.5 per cent. protein, and 11.4 per cent. fat, 70 per cent. of the protein being digestible. Experiments were carried on with 12 cows, all of which, during the first period of 4 weeks, were fed cottonseed meal. In the second period 6 of the cows were fed distillers' grains, the other 6 being continued on the cottonseed meal ration; during the third period, all the cows were fed cottonseed meal. In each period, corn silage, hay and corn meal were used as basal feeds. The results showed a noticeable increase in milk fat on the dried distillers' grains ration, due to the high percentage of digestible

fat which they contain. "The butter produced on the distillers' grains ration was not of quite as high a quality as that produced on the cottonseed meal ration." J. A. LECLERC.

**Dairymen's Association, Province of Ontario, Report for 1904.**

—On page 20 may be found a list of cattle foods together with their percentage composition of dry matter, ash, protein, fat and carbohydrates, and their nutritive ratio. The definitions and the functions of these substances are also given. On page 58 is found a discussion on the "Cool curing of cheese." Cheese-curing at 55–60° F. is considered the best. The objections to curing cheese at a lower temperature, say 40° F., are (1) heavy expense for insulation and refrigeration, (2) longer time required before the cheese would be fit to place on the market, (3) danger of such cheese showing "soft rinds" after a few weeks' storage. Cheese-curing at 55–60° F. is most satisfactory, as this temperature is more easily maintained than any other. The conditions which affect the shrinkage are (1) the temperature of the air, (2) the relative humidity of the air, (3) the percentage of moisture in the cheese; *e. g.*, a cheese cured at 60–80° F. lost three pounds one ounce in 6 weeks, whereas when cured at 58° F. the loss was only one pound one ounce. Other papers found in this report are "Curd Tests," "The Use of a Pure Culture in Cheese-making," "The Use of the Acidimeter," "Pepsin *vs.* Rennet for Coagulating Milk in Cheese-making" and "The Bacterial Contamination of Milk and Its Control." In the latter paper, it is shown that when milk is filtered through gravel, as is done by some of the Danish companies, more bacteria are found in the filtered than in the raw milk. The cleaning of milk by centrifuging removes the gross impurities but does not cause any decrease of bacteria. J. A. LECLERC.

**Food Adulteration.** By J. H. NORTON. *Arkansas Agr. Expt. Sta., Bull. 88.*—The bulletin discusses the subject of food adulteration briefly, including a discussion of the physiological action of preservative drugs found in food. It also gives the results of the examination of a considerable number of varieties of canned fruit and vegetables, jellies, jams, candy, honey, molasses, vinegar and baking-powder. The canned goods were examined only for preservatives; the jellies were examined for preservatives, coal-tar colors, saccharin, and glucose. In the case of baking-powder the nature of the acid ingredient was determined. The examination was for the most part of a qualitative nature and the detailed results of the quantitative examination are not ordinarily given. A description of the samples is given in tabular form. W. D. BIGELOW.

**Food Inspection.** *Maine Agr. Expt. Sta., Bull. 119.*—The bulletin discusses the subject of baking-powders and gives

the description of a number of samples of baking-powder to be taken for analysis. The results of their examination, however, are not given. The subject of vinegars is also discussed, and the percentage of acids, volatile acids, total solids, and ash of a large number of samples is given in tabular form.

W. D. BIGELOW.

**Vinegar.** BY A. MCGILL. *Laboratory of the Inland Revenue Department, Ottawa, Canada, Bull. 108.*—The composition is given of 242 samples of vinegar that were examined in connection with the enforcement of the food law of Canada. The examination made was confined to the determination of volatile acid and metallic impurity, and the physical character of samples was noted. Of the samples examined, traces of lead were found in 12 samples and traces of zinc in 2 samples. Notable amounts of sulphates and chlorides are reported in 6 samples. The amount of acetic acid determined varied from 2.22 to 9.15 per cent. Of the 242 samples examined, 37 were decided from the determinations made to be adulterated.

W. D. BIGELOW.

**Cream of Tartar.** BY A. MCGILL. *Laboratory of the Inland Revenue Department, Ottawa, Canada, Bull. 109.*—The analyses of 180 samples of cream of tartar collected from the open market throughout the Dominion of Canada are given. Of these, 15 were collected in each province. One hundred and forty-eight of the samples were examined by the various district analysts, and the remaining 32 in the Ottawa laboratory. Of the 180 samples examined, 132 were found to be genuine. The analyses made consisted of the determination of starch, alumina, sulphates, phosphates and acidity. A great range of value was found to exist among the samples classed as genuine, owing to the varying degrees of purification. Of the 132 samples reported genuine, 23 contained more than 97 per cent. cream of tartar; 32 more than 95 per cent.; 69 more than 90 per cent.; and 130 more than 85 per cent. A comparison of the results of this work is also made with the results of previous years since 1877. From this it appears that the quality of cream of tartar on the Canadian market steadily increased from 1887 to 1900, since which time there is a notable decrease in quality.

W. D. BIGELOW.

**Ground Pepper.** BY A. MCGILL. *Laboratory of the Inland Revenue Department, Ottawa, Canada, Bull. 106.*—The Inland Revenue Department has inspected pepper regularly since 1877, and this bulletin contains the results of the work done in 1905 in connection with the enforcement of the food law. A much larger number of samples is reported than has usually been the case. It is estimated that there are from 4,000,000 to 5,000,000 retail sales of pepper in Canada annually, and suggested that an adequate report cannot be made without the inspection of a



considerable number of samples. The analyses of 290 samples is reported, of which 117 were found adulterated. The examination was confined to the determination of ash and microscopical examination. A summary is also given of the results of the inspection of pepper since 1877, prior to the work covered by this report. During the entire period 1058 samples were examined, of which 557 were found to be adulterated. It was found that the highest percentage of adulteration occurs in and about Montreal.

W. D. BIGELOW.

**Condensed Milks and Infants' and Invalids' Foods.** By C. B. COCHRAN. *Special Report Pa. Dept. of Agr., Dairy and Food Division.*—The report includes the results of the examination of 22 samples of sweetened, 8 samples of unsweetened condensed milk, and 8 samples of infants' and invalids' foods. The report includes, in the case of condensed milk, the percentage of ash, fat, proteids, milk-sugar, milk solids, cane-sugar, total solids, contents of can and concentration. The amount of fresh milk equivalent to the contents of the can is given and also the composition of the product made by adding sufficient water to restore the milk to the original concentration. The report on infants' and invalids' foods gives the percentage of ash, fat, proteids, water, reducing sugar, cold water extract, direct polarization, invert polarization and dextrin. The presence or absence of starch is also noted.

W. D. BIGELOW.

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## PATENTS.

JUNE 6, 1905.

791,503. Richard E. Roehm, Newark, N. J. Assignor to Whitehead and Hoag Co., Newark, N. J. **Printing on pyroxylin.** Amyl acetate is put on the surface to make it porous and plastic; it is then coated with an adhesive and printed on, dried, hot pressed and finally chilled under pressure.

791,524-5-6. Hugo Witter, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. All for **yellow dyes.** Tetrazo-*p*-diaminodisulphonic acids are coupled with two molecular proportions of phenylmethylpyrazolone, the alkali salts being yellow to brownish powders, soluble in water and in concentrated sulphuric acid, the latter solution being yellow to green, and decomposing on reduction with stannous chloride and hydrochloric acid to characteristic products, and dyeing wool yellow. The second couples one proportion of  $\alpha$ -methylinol in place of a proportion of phenylmethylpyrazolone, and the third uses two proportions of  $\alpha$ -methylinol and no pyrazolone.

791,538. Charles G. Coburn, Orange township, Hancock Co. and Ezekiel T. Buckmaster, Bluffton, O. **Waterproofing**

**compound.** Crude petroleum 25, liquid asphalt and white drier 4 each, beeswax and gum arabic 1 part each.

791,555. Henry W. Hemingway, Walthamstow, England. **Stripping tin.** The tin is immersed in an acid solution of ferric sulphate, electrolyzed to deposit the tin on a suitable cathode and the bath revived by sodium nitrate.

791,577. Elfego Riveroll, Los Angeles, Cal. **Smelting ore.** The ore is subjected to the flame of fluid fuel imperfectly burned in one zone of a furnace, and to the flame of perfect combustion in another zone, giving a smelting heat whereby carbon is deposited on the ore in the first zone and the ore is deoxidized, the gases arising in the second zone being passed through the ore in the first zone.

791,631. Hugo Lieber, New York, N. Y. **Luminous paint.** Zinc sulphide, radium-barium carbonate and a special collodion, the solvent being alcohol-acetone 3 to 1.

791,675. Louis Descamps, Lille, France. **Hydrosulphites.** Finely divided pure zinc is added in slight excess to concentrated sulphurous acid, well stirred, the solution separated and caustic lime added to it.

791,869. René Bohn, Mannheim, Germany. **Brown anthracene dye.** Assigned to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. A formaldehyde derivative of 1,5-diaminoanthraquinone, a black powder, insoluble in water, giving a brown solution in caustic alkali and sodium hydrosulphite, dyeing cotton brown-red shades that turn browner on exposure to air.

791,928. Montague Moore, Melbourne, and Thomas J. Heskett, Brunswick, Victoria, Australia. **Making iron and steel.** The ore is dropped through a shaft furnace, the first temperature zone is at a red heat, the finely divided ore then goes into a separate deoxidizing zone with a deoxidizing gas supply, and the finely divided metal is smelted together in a third zone at a fusing temperature.

791,956. Clinton P. Townsend, Washington, D. C. **White lead.** A current of electricity is passed from a lead anode to a cathode through an electrolyte of sodium acetate containing a soluble carbonate, the lead compounds being excluded from the cathode by a suitable diaphragm, the pigment being produced within the confines of the electrolytic cell in the "anolyte" or anode compartment, into which  $\text{CO}_2$  is introduced.

791,960. Frederick J. Warren, Newton, Mass., Ralph L. Warren and Frank G. Cutter. Administrators of said Frederick J., deceased. **Bituminous composition.** Soapstone ground to an impalpable powder is added to the pitch.

791,971. Heinrich Winter, Charlottenburg, Germany. **Sugar**

**and molasses.** Massecuite is boiled to grain in the vacuum pan, a quantity of diluted and clarified runnings are added till the purity of the mixture is eighty for beet and sixty-five for cane; boil again to first strength, then cool in crystallizers and dilute with waste molasses before drying, the different mother-liquors being kept separate for use.

791,989. Tillmann Rams, Kansas City, Mo. **Preserving eggs.** Dry pulverized clay 100, ammonium carbonate 10, charcoal 10 and licorice 5 parts, a dry powder for packing eggs.

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792,011. Carleton Ellis, New York, N. Y. Assignor to Eldred Process Co., New York. **Generating combustible gas.** The generating of combustible gas by applying to a deep bed of ignited fuel, alternately a draft current of cooled products of combustion and air and one composed of steam and air in predetermined proportions, and passing this current under gentle pressure through the mass of fuel, thereby cooling the gas producer and forming combustible gas.

792,032. Martin Hertzberg, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York. **Blue-black azo dye.** A new dyestuff obtained by first combining the diazo compound of mononitroacetylparaphenylenediamine with 1,8-dioxynaphthalene-3,6-sulphonic acid and then splitting off the acetyl group by saponification. The dyestuff in the shape of its sodium salt is a dark powder soluble in water with a bluish-violet color, being dissolved by concentrated sulphuric acid of 66° Bé. with a bluish black color which is changed into red by the addition of ice, dyeing unmordanted wool bluish black shades, and yielding upon reduction with stannous chloride and hydrochloric acid triaminobenzene and 1,8-dioxy-2-amidonaphthalene-3,6-disulphonic acid.

792,033. Same. **Black azo dye.** A dyestuff obtained by first combining in acid solution the diazotized mononitroacetylparaphenylenediamine with 1,8-aminonaphthol-3,6-disulphonic acid and then splitting off the acetyl group by saponification. The dyestuff in the form of its sodium salt is a dark powder soluble in water with a bluish violet color, and being dissolved by concentrated sulphuric acid of 66° Bé. with a bluish black color which is changed into red by the addition of ice, dyeing unmordanted wool bluish black shades, and yielding, upon reduction with stannous chloride and hydrochloric acid, triaminobenzene and 1,2-diamino-8-naphthol-3,6-disulphonic acid.

792,034. Same. **Azo dye.** A dyestuff obtained by first combining in alkaline solution the diazotized mononitroacetylparaphenylenediamine with 1,8-aminonaphthol-3,6-disulphonic acid and then splitting off the acetyl group by saponification.



The dyestuff in the shape of its sodium salt is a dark powder soluble in water with a bluish violet color, being dissolved by concentrated sulphuric acid of 66° Bé. with a bluish black color which is changed into red by the addition of ice, dyeing unmordanted wool greenish blue-black shades and yielding upon reduction with stannous chloride and hydrochloric acid triamino-benzene and 1,7-diamino-8-naphthol-3,6-disulphonic acid.

792,070. Carrie R. Plumer, Seattle, Wash. **Hardening and tempering copper.** Copper or its alloys are subjected to a high temperature and while in the heated condition is treated with about one per cent. of sulphate of copper. It is then poured into molds and is finally subjected to the action of sulphur until it is coated with a black sulphur oil, and allowed to harden.

792,113. William N. Blakeman, Jr., New York, N. Y. **Paint oil.** A compound mixture of an oil, an elaidinized oil, and a drying oil. An elaidinized oil is one treated with an oxide of nitrogen.

792,114. Same. **Paint.** A mixture of an elaidinized non-drying fatty oil and a pigment.

792,123. Carleton Ellis, New York, N. Y. Assignor to Eldred Process Co., New York, N. Y. **Manufacturing glass.** The raw materials are treated to a high temperature by means of combustible gas, withdrawn from the gaseous products of the reaction of the glass mixture and passed in company with air or oxygen through a deep bed of fuel to produce a combustible gas, which, owing to the relatively low amount of nitrogen, is of high calorific value and is low in carbon dioxide.

792,148. Ernesto Monteleone, Jersey City, N. J., and Vincenzo Caesareo, New York, N. Y. **Lotion.** A lotion composed of water 800, borax 10, algazu 3, and almond oil 1.5 parts. Algazu is African.

792,149. Harry S. Mork, William H. Walker and Arthur D. Little, Boston, Mass. A method of making artificial silk by dissolving cellulose acetate in a solvent composed of a material of high volatility and a material of low volatility, then adding to the solution a small quantity of a non-volatile material, then projecting the solution through small holes into a coagulating compound, then twisting together a plurality of the filaments, then winding and drying under tension. Chloroform 1000, cresol 50, and oleic acid 50 parts are used as the solvent.

792,205. George Eschellmann and Albert Harmuth. Assignors to Tov. Tentel'evskage Ximichesk Zavoda, St. Petersburg, Russia. **Sulphuric anhydride.** A gas chamber with supply pipe has a catalytic layer on its bottom and below it, in a smaller vessel, and a pre-heater arranged at the side, said preheater being constructed like a tubular boiler.

792,218. Frederick Jochen, Jersey City, N. J. Assignor to Jochen Silk Weighting Co., New York, N. Y. **Treating silk.** Silk is first treated in a bath of tin bichloride and washed; it is then put in a bath consisting of an alkaline solution of casein and sodium phosphate, and again washed.

792,259-260-261. Jacob Grossmann, Manchester, England. Assignor to The Grossmann Cyanide Patents Syndicate Limited, same place. **Making cyanides.** Ferrocyanides are decomposed by a mineral acid and the hydrocyanic acid evolved is absorbed in caustic alkali. The metallic ferrocyanide obtained as residue is reconverted into ferrocyanide by boiling with caustic alkali in the presence of air in excess.

792,307. Anson G. Betts, Troy, N. Y. **Electrodepositing antimony.** A solution of antimony trifluoride is electrolyzed with an insoluble anode of lead and a suitable cathode as antimony.

792,314. William B. Chisolm, Charleston, S. C. **Fertilizer.** The production of a fertilizer by boiling together sulphur and lime to produce a homogeneous liquid, and mixing therewith finely ground phosphate.

792,379. Hermann A. Abendroth, Berlin, Germany. **Ammonia still.** A column still, the bottoms of the cells being constructed of terraces declining from the inflow to the outflow.

792,421. Paul Julius and Ernest Fussenegger, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Azo dye.** A coloring-matter obtained by combining diazotized nitroxyldine ( $\text{NH}_2:\text{NO}_2:\text{CH}_3\text{CH}_3=1:3:4:6$ ) with 2-naphthol-3,6-disulphonic acid, which is soluble in hot water and yields an insoluble barium salt and which, upon reduction with tin and hydrochloric acid, yields 4,6-diaminometaxylylene and aminonaphtholdisulphonic acid.

792,458. Rasselas P. Reynolds, Walla Walla, Wash. **Timber preservative.** A timber preservative composed of coal tar 8, Portland cement, asbestos, sulphur and resin 1 part each, and cresote 1 part, if refined, or 4 parts crude.

792,462. Cipriano Salazar, Albuquerque, and Enrique H. Salazar, Las Vegas, N. Mex. **Compound for cleaning boilers.** One gallon of water, 12 ounces of Gobernadora, and 4 ounces of *Covillea tridentata* are boiled together and strained. Gobernadora is a Hediondia.

792,511. Adolph Frank, Charlottenburg, Germany. **Explosive.** Contains an oxygen-yielding substance, as ammonium nitrate, and more cyanamide than may be oxidized by the oxygen evolved in the process.

792,512. Same. **Explosive.** Containing nitrocellulose and nitroglycerol and more cyanamide than may be oxidized by the oxygen evolved in the process.

792,515. Jacob Grossmann, Manchester, England. **Making nitrites.** Nitrates are fused with graphite in the presence of an oxide and a hydroxide of an alkaline earth to produce an alkaline nitrite.

792,518. Emma Homann, Berlin, Germany. **Remedy for tree-cancer.** The remedy consists of 97 parts of chlorinated carbolineum, two parts of soap and 1 part of copper-vitriol solution containing 1 per cent. of copper sulphate.

792,544. James Newman, Washington, D. C. **Sweeping compound.** Sawdust of wood having insecticidal properties, as cedar wood and creosote.

JUNE 20, 1905.

792,600. Karl Krekeler, Elberfeld, and August Blank, Leverkusen, Germany. Assignors to Farbenfabriken of Elberfeld Co. **Reddish azo dye.** Obtained by combining the diazo derivative of orthotoluidine with the metaaminophenyl-1,2-naphthimidazol-5-oxy-7-sulphonic acid, which in the form of its sodium salt is a red powder, soluble in water with a red and in concentrated sulphuric acid with a bluish-red color, yielding upon reduction with stannous chloride and hydrochloric acid orthotoluidine and metaaminophenyl-1,2-naphthimidazol-5-oxy-6-amino-7-sulphonic acid which gives a red dye by combination of its diazo compound with 2-naphthol-3,6-disulphonic acid, dyeing unmordanted cotton red shades, which shades can be further diazotized and developed on the fiber by means of  $\beta$ -naphthol, pure red shades being thus obtained which are fast to washing and light.

792,629. William Sunderland, Lehi, Utah. **Treating Balsamorhiza.** A process of obtaining fiber, rubber-gum, resins and other bodies from the roots of the plant *Balsamorhiza* which consists in removing the bark, boiling them in an alkali solution and removing the floating gum; fermenting in water rendered alkaline and carding the fiber and evaporating the alkali solution to dryness.

792,632. Harry Tee, Seaforth, England. **Salt.** The process of manufacturing white salt from discolored or impure rock-salt, consisting of melting the discolored or impure salt, then purifying by forcing air through it while in the molten condition, and effecting the separation of salt and the impurities in it in a molten and quiescent state.

792,683. Friedrich S. Valentiner, Leipsic, Germany. Assignor to Compagnie "Morana" Société Anonyme, Zurich, Switzerland. **Sulphuretted hydrocarbons.** Producing sulphuretted hydrocarbons by condensing aldehydes with sulphuretted hydro-

carbons of the general formula 
$$\begin{array}{c} \text{R} \\ \diagdown \\ \text{C} \\ \diagup \\ \text{R} \end{array} \text{—S} \text{ in the presence of a}$$



condensing agent, as by condensing aldehydes with acetones in the presence of metallic sulphides.

792,716. Hudson Maxim, New York, N. Y. **High explosive compound.** An explosive compound, consisting of picric acid and dinitrophenol associated in solution with each other, the carbon and oxygen in the mixture being substantially in the ratio of their atomic proportions, and the melting-point of the compound being less than that of either of the ingredients.

792,720. John Murphy, Columbus, Ohio. **Composition for artificial stone.** Kaolin and white clay 15 parts each and calcareous rock 60 parts.

792,783. Wilhelm Muthmann, Munich, Germany. Assignor to the Roessler and Hasslacher Chemical Co., New York, N. Y. **Prussic acid.** The manufacture of prussic acid by passing nitrogen and hydrocarbon in gaseous mixture through a high voltage electric flame.

792,826. Fritz Hilpert, Nuremberg, Germany. **Coating with silver.** A solution of silver nitrate in water is treated with ammonia until a yellow precipitate appears and is redissolved. A reducing solution is made consisting of equal parts of Rochelle salt and rock candy to which an aqueous solution of silver nitrate is added. The solutions are mixed and boiled for a short time, the mixture is then spread upon a plate of glass allowing a deposit to form, and the plate is then dried and washed. The paper or other material to be coated is treated with gelatin or shellac to which the silver coat is made to adhere by placing the material to be coated in contact with the deposit on the glass plate and drying by heat.

792,828. Jerry M. Hudson, Cleveland, Ohio. **Composition for use in cores.** Forty to 60 parts of marble dust and 60 to 40 parts of wheat flour.

792,873. Joseph H. Amies, Philadelphia, Pa. **Pavements.** A method of constructing bituminous, macadam or other pitch pavements, in which is described the preparation of the bed upon which is placed a facing of coarse and fine stone proportioned to secure the greatest inherent stability, then wetting them and mixing them with granulated quicklime, then mingling them with asphaltic cement.

792,886. Max Englemann, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Dialkyl barbituric acid.** The production of 2,4,6-trioxy-5-diethylpyrimidine by first heating 2-cyanimino-4-imino-5-diethyl-6-oxypyrimidine with acids and then isolating the diethylbarbituric acid from the reaction mass.

792,888. Charles A. Ernst, Lansdowne, Pa. **Manufacturing filaments from viscose.** Viscose is first set by immersion in a bath containing an inert organic reagent, an organic acid, and a salt soluble in such acid, and then reverting the viscose

by immersion in a bath of an inert organic reagent and an acid. Methyl alcohol, to which 6 per cent. acetic acid is added and the whole saturated with sodium acetate, is preferred.

792,914. Niven McConnell, Pittsburg, Pa. **Open-hearth steel.** A pool of molten pig metal is blown in an acid-lined converter, then transferred to an intermediate furnace heated externally, from which successive charges are carried to basic open-hearth furnaces to be dephosphorized and decarbonized.

792,932. Josef von Schmaedel, Munich, Germany. **Printing paper.** Printing paper containing a soluble glucoside, such as saponin, in the proportion of 100 kg. paper pulp to 200 grams saponin, or the saponin may be introduced in combination with a resin emulsion containing 50 to 600 grams saponin to 1 kg. resin.

793,026. Henry S. Blackmore, Mount Vernon, N. Y. Assignor to Black-Ford Utility Oil Co., of the District of Columbia. **Separating sulphur from petroleum and making hydrogen carbide.** The sulphur is removed from petroleum by exposing it to the action of an alkali-earth carbide, as calcium carbide, at a reacting temperature, say 360° F.

793,034. James Kitsee, Philadelphia, Pa. **Making paper bags.** The surface of the paper is nitrated, dried, and the edges remoistened so as to adhere and form a bag.

793,039. Anson G. Betts, Troy, N. Y. **Treating by-product metal mixtures in electrolytic metal refining.** The anode slimes from the electrolytic refining of lead are treated with a solution having a solvent power on some of the metals of the slime, when oxidized, and with an oxidizing compound, all the elements of which, when reduced, remain in solution with the exception of a portion which may combine to form insoluble solid compounds, separating the solution from the insoluble material, and reoxidizing the compound which has been reduced to its original condition of oxidation. Ferric sulphate with 2 per cent. of free sulphuric acid is used, then scrap iron to precipitate copper, and the remaining solution is electrolyzed to re-oxidize the oxidizing agent.

JUNE 27, 1905.

793,048. Luther P. Brown, North Adams, Mass. **Water-proofing paper.** Paraffin 8, paraffin oil 1, Brazilian wax 3, talc 6, asbestos 2 and chalk 1 (both in powder), beeswax, bayberry wax, petroleum and ceresin 1 part each.

793,078. Harry C. Hubbell, Jersey City, N. J. **Cathode.** A foraminous nickel foundation with silver oxide deposit on opposite sides but the edge not covered, a layer of asbestos paper surrounding the deposit and the whole placed in a wire gauze pocket held in place by channeled binding-strips crimped on the edges of the pocket.

793,112. Rome V. Wagner, Chicago, Ill. **X-ray tube.** A movable electrode is supported by a hollow screw-threaded stem screwed on to a threaded post, an armature is connected to the stem and an armature-holder to the post.

793,138. Arthur B. Larcher, Oldtown, Me. Assignor to Penobscot Chemical Fiber Co. **Electrolysis apparatus.** A porous diaphragm separates two bodies of liquid having anode and cathode respectively, the passage of caustic soda and salt through the diaphragm being regulated by the relative depth of the liquid in the two chambers.

793,181. James P. Crane, Chicago, Ill. **Rubber compound.** Soft vulcanized rubber is filled with metallic wool in fibers, thereby making a hard-wearing surface.

793,186. Gustave Gin, Paris, France. **Extracting copper.** The ore is roasted, lixiviated with sulphurous acid, heated to precipitate iron and to decompose the cuprosocupric sulphite, then filtered and the precipitate washed, the residual iron sulphite oxidized to a sulphate, leached out and washed.

793,315. James W. McIndoe, Boston, Mass. Assignor one-half to Arthur E. Whitney, Boston, Mass. Making **printing dies.** A smooth metallic base is selected and, together with a piece of fabric it is desired to imitate, coated with shellac, dried, coated again and pressed together; another coat of shellac is given and dried, then the whole is dipped in silver nitrate, dried and put in ferric sulphate, dried again and coated with copper in an electrolytic bath; the result will be a copper printing surface.

793,464. Joseph McMahan, New York, N. Y. **Extracting oils.** The ground seeds are treated in a closed receptacle to carbon dioxide to expel air, then with a volatile solvent as benzene to exhaust the material, driving out the carbon dioxide, then removing the solvent by means of carbon dioxide, which absorbs the last traces of the solvent and is conducted into a solution of sodium carbonate to recover the reagents.

793,542. Wm. F. Rosencrans, Stamford, Vt. **Wood alcohol apparatus.** A fire-box, a pair of retorts, a tubular heater for the products of combustion from the fire-box, placed so as to protect the retorts from excessive heat, a boiler and suitable connecting pipes.

793,543. Max Schroeder, Dusseldorf, Germany. **Catalytic apparatus.** Superposed separate layers of catalytic material have open spaces between them with small central passages for the passage of the gases from one bed to another, the material being supported on perforated screens. WILLIAM H. SEAMAN.



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## METALLURGICAL CHEMISTRY.

**The Mineral Resources of the Philippines.** By H. D. McCASKEY. *Eng. Min. J.* June 1, 1905 (from Annual Report Mining Bureau of the Philippines).—A comprehensive report of the gold, copper, lead, silver, platinum, zinc, tin, manganese, iron, mercury and antimony ores; also of the coal, petroleum, salt, gypsum, limestone, marble, clays, building stone, guano and opal deposits. These will form the basis of an important industry; the present stage is one of investigation and development.

J. W. RICHARDS.

**The Snyder Magnetic Separator.** By F. T. SNYDER. *Eng. Min. J.* September 2, 1905.—The magnetic rolls are of laminated iron disks in which magnetism is generated by induction, so that one side of the roll is north, the other south, and in between neutral. As the roll revolves, the magnetic material is strongly attracted and held at the pole, but less and less strongly as it approaches the neutral point, the particles thus dropping off in the order of their magnetic attraction, the strongest last. The different products fall into separate slits. Centrifugal force helps also to detach the particles. Unwasted pyrite, blende and pyrrhotite are separated, and zinc, iron and manganese ores concentrated to commercial products with a saving of 80 to 95 per cent. of the values in the concentrate.

J. W. RICHARDS.

**Pyritic Smelting.** By J. P. CHANNING. *Eng. Min. J.* June 22, 1905.—Description of running of smelting furnaces by the Tennessee Copper Company, 56 inches by 270 inches at the tuyeres, treating 375 tons of ore per day, using 17,000 cubic feet of air (delivered) per minute. The charge works best and eliminates most sulphur when 12 to 14 feet deep. The matte and slag flow continuously into a circular settler 16 feet in diameter,

lined with chrome brick. The matte is tapped intermittently, and cast in flue-dust beds; when cold it is broken small, and taken to the matte-smelting furnace. This is similar to the ore smelter, the charge being, however, matte, quartz, converter slag, and furnace cleanings. The matte produced is 45 to 55 per cent. and is taken directly to the converters. Four more furnaces of the same size as the above are being constructed, with 26 3-inch tuyeres on the back and 24 at the front. The pyritic smelting saves 40 cents per ton cost of roasting, the cost of smelting is the same, about 0.2 per cent. more copper is saved in matte, and the furnace gases are so rich in sulphur dioxide that they can be used in sulphuric acid chambers. Careful analyses of the matte showed it to consist of  $\text{Cu}_2\text{S}$ ,  $\text{FeS}$  and  $\text{Fe}_3\text{O}_4$ , there being a deficit of 5 to 10 per cent. of sulphur from the usual formula  $\text{Cu}_2\text{S}$ ,  $\text{FeS}$ , the difference being due to the  $\text{Fe}_3\text{O}_4$  present.

J. W. RICHARDS.

**Improved Slag Treatment from Copper Reverberatories.** BY H. V. PEARCE. *Eng. Min. J.* June 15, 1905 (from *Bull. Am. Assoc. Min. Eng.*)—Instead of skimming off the slag, it is allowed to collect till ready for tapping, then run out at a slag spout by breaking down a small dam of clay and sand. The slag is run into a small reverberatory, where it is kept melted, 1000 pounds of pyrite ore sprinkled on it, and let stand two hours. Then the clean slag is tapped out by tearing down a dam, in just the same manner as from the large furnace. After thus treating about 20 batches of slag, 4 to 5 tons of low-grade matte will have accumulated in the small reverberatory, the slag is skimmed off clean and the matte tapped.

J. W. RICHARDS.

**New Method of Metallurgical Treatment of Copper Ores.** BY N. S. KEITH. *J. Franklin Institute*, August, 1905.—The author states that vast (?) deposits of sandstone occur in the Appalachian ranges, containing copper, chiefly as chalcocite,  $\text{Cu}_2\text{S}$ , in amounts of 1 to 3 per cent., with gold and silver from traces to several dollars worth per ton. The proposed method is to grind the ore fine, mix it with 3 per cent. of its weight of powdered coal. These are dropped in a shower down a shaft, up which is passing burning producer gas, with excess of air. The ore is first oxidized by the air, then lower down reduced by the producer gas and coal dust to the metallic state and fused to globules. The heat is said not to fuse the silica or lime present. The dust is flushed from the bottom of the shaft by a current of water, carried onto concentrating tables, and the metallic concentrates dried and melted down. If gold and silver are present, they are obtained by electrolytically refining the melted-down copper. The author estimates the cost at one dollar per ton, treating 100 to 200 tons per day. A question mark can very properly be placed after

each step of the proposed process, except the grinding of the ore and the proposed electrolytic refining of the copper.

J. W. RICHARDS.

### **Effect of Impurities on the Electrical Conductivity of Copper.**

*Brass World*, August, 1905 (read before the American Institute of Mining Engineers.)—The paper dealt with the influence of quite small amounts of impurities. Lead, bismuth and tellurium reduce the conductivity only slightly, yet make the metal extremely brittle; phosphorus, aluminium and silica added in small quantity deoxidize the metal, but if left over in it, reduce its conductivity very strongly. The relative effects of equal weights in reducing the conductivity are as follows: Lead 3, bismuth 4, tellurium 4, silver 6, sulphur 8, cadmium 9, gold 10, oxygen 25, zinc 30, tin 67, silicon 70, iron 140, antimony 190, aluminium 500, arsenic 720, phosphorus 3,000. The rate at which the above reduce conductivity can be calculated from the datum that 0.1 per cent. of an element which would be rated at 100 on the above scale would reduce the conductivity 6 per cent.

J. W. RICHARDS.

**Manganese-Copper Resistance Wire.** BY E. S. SPERRY. *Brass World*, August, 1905.—Pure manganese, made by the use of aluminium, is too expensive to use; ferro-manganese contains some 10 to 15 per cent. of iron and 6 per cent. carbon, and is therefore unsuitable. If copper be melted with ferro-manganese, however, the carbon is expelled largely as kish, and a cupro-ferro-manganese can be made, analyzing 65 copper, 32 manganese and 2.5 iron. By remelting several times, all carbon can be removed; otherwise it forms some hard steely spots with the iron. When all carbon is thus burnt out, the iron alloys perfectly with the copper. Alloys made with addition of more copper contain 85 copper, 11 to 15 manganese and 1 to 3 per cent. of iron, and are rolled or drawn. When in wire it has a tensile strength of 80,000 to 110,000 pounds hard drawn, and 55,000 to 65,000 pounds annealed, with 1 to 2 per cent. elongation in the first case and 15 to 25 in the latter. The electrical conductivity is 3 to 4.5 per cent. that of copper. It makes therefore excellent resistance wire. The alloy called "manganin" was found on analysis to contain 0.57 per cent. iron, 2.29 nickel, 15.02 manganese and 82.12 copper. The nickel lowers the temperature coefficient of its electrical resistance, and raises the melting-point, so that it melts less easily if overheated. The alloys containing iron are slightly magnetic. They are best made from pure manganese, free from iron, and bid fair to replace German silver as resistance material. J. W. RICHARDS.

**The Manufacture of Bronze Rods.** BY E. S. SPERRY. *Brass World*, May, 1905.—A very common mixture is copper 90 parts,



zinc 9, tin 1. An improvement is made by using 0.01 per cent. of phosphorus, making the mixture copper 90 parts, zinc  $9\frac{3}{4}$ , 5 per cent. phosphor-tin  $\frac{1}{4}$ . This gives all the phosphorus needed; 0.05 per cent. of phosphorus, such as is used in bronze for rolling or drawing, is too much for rods. The phosphorus accumulates somewhat if the scrap, etc., is remelted, sometimes to such an extent as to make the rods red-short. Manganese is in this case substituted for phosphorus as a deoxidizer, the mixture being copper  $88\frac{1}{2}$  parts, zinc 10, tin 1, 20 per cent. manganese copper  $\frac{1}{2}$ . The manganese does not accumulate in the remelted metal, and is better than phosphorus.

J. W. RICHARDS.

**Trolley Wheels.** By J. J. VANDERGRIFT. *Brass World*, May, 1905.—The standard trolley wheel mixture is 92 parts copper, 6 tin and 2 zinc. The tin gives stiffness and good-working qualities; the zinc imparts solidity to the casting. Under no consideration should lead be used, for it makes the wheel wear out on very low mileage. The bushing of the wheel should be a highly-leaded anti-friction bronze. A yellow brass trolley wheel is entirely useless.

J. W. RICHARDS.

**Corrosion of Brass and Bronze by Mine Water.** By J. JONES. *Metal Industry*, September, 1905.—Samples of various metals were placed in mine water at Audenried, Pa., by Mr. G. B. Hadesty. The metals were: *Hydraulic metal*, made up of copper 100, tin 10, yellow brass 25, and containing copper 83.05 per cent., lead 0.10, tin 10.81, zinc 6.00; remelted once. *Red brass*, made up of copper 100, tin 10, lead 10, zinc 4; analyzing copper 80.75 per cent., iron 0.05, lead 8.74, tin 8.73, zinc 1.73. *Muntz metal*, rolled, analyzing copper 57.55 per cent., iron 0.38, lead 0.56, tin 1.49, zinc 40.02. *Bronze*, made of copper 100, tin 20, analyzing copper 82.30, tin 17.70 per cent. *Manganese bronze*, cast and chilled specimens, copper 57.20 per cent., zinc 40.14, manganese 0.03, tin 1.18, iron 1.33, lead 0.02, aluminium 0.10; the rolled specimen contained copper 62.45 per cent., zinc 36.00, manganese 0.02, tin 0.63, iron 0.84, lead 0.06. The loss of weight by immersion for one year, resting on a cast-iron block, and immersed in the mine water strong with sulphuric acid, was:

	Per cent.
Hydraulic metal.....	0.58
Red brass.....	0.70
Muntz metal, rolled.....	1.83
Copper-tin bronze.....	2.00
Manganese bronze, chilled.....	3.37
“ “ rolled.....	4.36
“ “ cast.....	6.37

J. W. RICHARDS.

**White Brass as an Anti-friction Metal.** By J. JONES. *Metal Industry*, May, 1905.—An alloy of 64 parts tin, 34 zinc and 2

copper makes a good antifriction metal; if a stronger metal is required, the copper is made 4 to 8 parts, but the friction and wear increase correspondingly. Its electrical conductivity is 16.71 (copper = 100), while that of Babbitt metal is 8.5; the white brass has therefore advantages in electrical machinery. Its tensile strength is 12,500 pounds per square inch, elastic limit 8,000, elongation in 2 inches 20.5 per cent., reduction of area 17.5 per cent., specific gravity 7.32, shrinkage 0.04 inch per foot, melting-point (2 per cent. copper)  $360^{\circ}\text{C}$ . ( $680^{\circ}\text{F}$ .), with 4 per cent. copper,  $505^{\circ}\text{C}$ . ( $940^{\circ}\text{F}$ .), coefficient of friction 0.0077, rise in temperature (at 446 revolutions per minute and 250 pounds pressure per square inch)  $17^{\circ}\text{C}$ . ( $30.5^{\circ}\text{F}$ .); relative value as bearing metal 290.8 (standard Babbitt metal = 100.)

J. W. RICHARDS.

**Tempered Lead.** BY E. S. SPERRY. *Brass World*, July, 1905.—An antifriction metal recently sold is found on analysis to contain 98.51 per cent. lead and 1.30 per cent. sodium, with 0.08 tin and 0.11 antimony. It is much harder than pure lead, and has a ring similar to brass. To make it, the lead is melted, the sodium taken in small pieces from under the petroleum and pushed down under the lead, when they immediately combine. When poured into moulds a film of lead oxide forms, which can be obviated by pouring a thick oil on the melted metal in the mold before it has set. Ingots should be coated with oil, paraffin or lacquer to prevent oxidation. When used for antifriction purposes, the caustic soda formed by oxidation probably unites with the oil to form a lubricating soap. J. W. RICHARDS.

**Air in Roasting.** BY W. A. GREENWALT. *Eng. Min. J.*, August 19, 1905.—Plenty of free oxygen is necessary for good roasting; and, for this purpose, the bed of ore should not be too thick. Two furnaces were run on the same ore, No. 1 with the ore bed  $2\frac{1}{2}$  inches deep, the rabble blades at  $22\frac{1}{2}^{\circ}$ , and the ore about two and a half hours in the furnace; No. 2 with ore bed  $4\frac{1}{2}$  inches deep, rabble blades at  $12^{\circ}$ , and ore about five hours in the furnace. Furnace No. 1 turned out 100 tons of ore per day, roasted to 0.92 per cent. sulphur, and from which 94 per cent. of its gold was extracted by chlorination; furnace No. 2 turned out 70 tons of ore per day, roasted to 0.82 per cent. sulphur, and extraction of gold 73 per cent. The ore in both tests was crushed to 12 mesh and chlorinated three hours with a charge of 15 pounds of "bleach" and 20 pounds of acid per ton of ore.

J. W. RICHARDS.

**Temperature in Roasting Gold Ore.** BY W. E. GREENWALT. *Eng. Min. J.* July 29, 1905.—Laboratory tests showed higher extraction of gold by chlorination when the roasting was done

at a very low temperature, finishing at dull red. The tests were repeated on large furnaces roasting 100 tons of ore daily, furnace No. 1 being run with low initial heat and a high finishing heat, and No. 2 with a higher initial heat and a lower finishing heat. The ore was chlorinated with the following results as to extraction on four different days' runs:

No. 1. Per cent.	No. 2. Per cent.
92.4	94.6
93.4	93.5
90.0	93.7
90.0	94.0

J. W. RICHARDS.

**The Development and Present Status of Cyanidation in the United States.** BY W. H. DAVIS. *Electrochemical and Metallurgical Industry*, July, 1905.—An exhaustive review of this important gold-winning process, covering the history of the process, crushing, acidity of ore, use of alkalies, treatment of coarse sands, slimes, high-grade ores, precipitation, cleaning up, refining, and regeneration of the solution. The cost is put at \$0.55 to \$0.60 per ton. The author advocates more tanks and longer time of treatment, so as to get greater extraction, which he believes should average 90 per cent. Conical-bottom tanks, for treating slimes, are now in use at Florence, Colorado, combining agitation and decantation with filter-press treatment of the decanted solutions. Raw gold telluride ore dust, without roasting, is thus treated five days, and an extraction of 93.5 per cent. obtained, consuming 2 pounds of cyanide per ton of slimes. American practice has also tended towards treating higher grade ores, extractions of 95 to 96.5 per cent. having been obtained on Cripple Creek telluride ores valued at \$80 per ton, when crushed fine. The Davis method of regenerating the solution has been used three years at the Smuggler Union Mine. The solution, in the storage vat, is subjected to alternating current electrolysis for twenty-four hours, slaked lime being added to it. A set of lead electrodes lasts six months; the plates are kept the diameter of the tank apart. They are as long as the tank is high, 6 inches to 1 foot wide, and 0.05 to 0.1 ampere per ton of solution present in the tank is sent through, at 60 cycles per second. The use of this method has resulted in a reduction in cyanide used from 1.11 down to 0.78 pound per ton of ore, and an increased extraction of 17.09 per cent. of gold and 4.81 per cent. of silver from the ore. Each six months, some 75 tons of precipitated lime and metallic oxides are removed from the storage tank.

J. W. RICHARDS.

**Cyanidation of Silver Ore.** BY A. CHIDDEY. *Eng. Min. J.* June 1, 1905.—As used at El Salvador, the ore contained silver



sulphide, and was first given a chloridizing roasting, then amalgamated in pans, and the tailings cyanided. Afterwards, it was found that the raw ore could be satisfactorily cyanided, and the above-described process has been abandoned. Now, the ore from the arrastra is divided into sands and slimes, each is separately cyanided and the solutions precipitated by zinc shavings. The copper is under 0.1 per cent., and gives no trouble. The sand contains 13 to 15 ounces of silver and 0.15 to 0.25 ounce of gold, and the extraction averages 85 to 90 per cent. of the silver and 90 to 92 per cent. of the gold, consuming 2 pounds of cyanide per ton.

J. W. RICHARDS.

**Silver Electrolytic Refining.** By A. G. BETTS. *Eng. Min. J.* September 2, 1905.—The author has patented the use of a solution of silver methylsulphate containing 4 per cent. of silver and 4 per cent. of free methylsulphuric acid, to which is added 0.008 to 0.007 per cent. of gelatine or gum-arabic solution. The current density used is 10 amperes per square foot, and the deposits do not fall off, but can be easily scraped from the cathodes outside of the tank. No bags are necessary for enclosing the anodes, and the slime collects in the bottom of the tanks. Bismuth goes into solution, but accumulates there, and is precipitated by metallic lead. The lead is in its turn precipitated by silver sulphate, thus regenerating a clean solution.

J. W. RICHARDS.

**Bag-Houses for Saving Fume.** *Eng. Min. J.* July 15, 1905.—A collection of data concerning the design of bag filtering plants. The cost of maintenance and attendance is 10 to 25 cents per ton of ore treated in the furnaces. About 1,000 square feet of filtering surface are needed per ton of charge smelted per hour. In making zinc oxide, the filtering surface is 150 to 200 square feet per square foot of grate area working. The cloth should weigh 0.4 to 0.7 ounce average per square foot, and have 42 to 48 threads per linear inch. The gas may be introduced into the bags at 250° F., but never above 300° F., as that temperature may ignite them. If much sulphur dioxide is present, the bags should be of unwashed wool, since the natural grease in it protects it from rotting.

J. W. RICHARDS.

**The Aluminium Industry.** *Metal Industry*, May, 1905. (From *Bull. U. S. Geological Survey*).—The Pittsburg Reduction Co. has 1,200 horse-power in use at Massena, N. Y., 5,000 horse-power at Shawinigan Falls, Canada, and 14,000 horse-power at Niagara Falls. It is reported that 27,000 additional horse-power has been contracted for at Niagara. The present output of the company is 4,850 tons of metal yearly.

J. W. RICHARDS.

**Aluminium Skimmings.** *Brass World*, November, 1905.—The copious skimmings made in melting aluminium contain oxide mixed with metal. They are best saved up for treatment alone. They are run down in a crucible, using as flux a mixture of half salt and half fluorspar, at a low red heat. The fluorspar can dissolve 2 per cent. of its weight of aluminium oxide, and the salt helps to collect the metal together. J. W. RICHARDS.

**Anodes in Gold-plating Baths.** BY C. H. PROCTOR. *Metal Industry*, May, 1905.—On account of the solubility of gold in cyanide solutions, gold anodes dissolve faster than gold is plated out, and using large anodes the bath would be enriched too far in gold. This is avoided by using small gold anodes, and some supplementary platinum anodes, which are not attacked. The author has found that rolled sheet nickel acts as well as platinum, being scarcely perceptibly attacked, and the gold-plating appears really to come from the bath brighter than when platinum is used. Some firms plate nickel with the gold, by using nickel salts in solutions, claiming to produce a brighter and harder plating. J. W. RICHARDS.

**A New Brass-plating Solution.** BY H. J. HAWKINS. *Metal Industry*, July, 1905.—A solution is made up, using 16 ounces cyanide of potassium, 12 ounces copper carbonate and 4 ounces ammonia water to 1 gallon of water. The anodes used are yellow sheet brass cut into thin strips 1 to 2 inches wide. The solution is worked hard for several days, when the deposit changes from red to brass color, almost exactly the color of the anodes. A 500-gallon solution, made as above, was worked continuously several months with uniformly satisfactory results, carbonate of copper being added once a week and ammonia water twice a week. J. W. RICHARDS.

**A New Red Dip for Coloring Silver.** BY E. S. SPERRY. *Brass World*, May, 1905.—A solution of 15 grains uranium nitrate in 4 fluid ounces of water is made; then another of 15 grains ferricyanide of potassium in a similar amount of water. The solutions are then mixed in the proportions given above, adding 1 fluid ounce of strong acetic acid and 8 of water. The solution is used warm in a porcelain dish, the silver article, first cleaned from oil and grease, being immersed and moved about until of the desired red color. It is then rinsed, dried and lacquered. The same solution gives good results on brass, copper, lead or tin, but none on zinc or iron. J. W. RICHARDS.

**Replenishing the Nickel-plating Bath.** BY C. H. PROCTOR. *Metal Industry*, May, 1905.—Dissolve 10 pounds of single nickel sulphate in 2 gallons of boiling water, and add to a 200-gallon bath. Then its conductivity is increased by adding 10 ounces

of commercial sulphuric acid and afterwards 30 ounces of 26 per cent. ammonia water. The bath is thus treated in the evening and allowed to stand over night. The addition of 1 to 2 ounces of sodium bisulphite to each 5 gallons of electrolyte is useful in plating small work by the tumbling-crate method.

J. W. RICHARDS.

**White Nickel-plating.** *Brass World*, August, 1905.—An extremely white, soft deposit can be obtained by utilizing both boric and benzoic acids in the solution. The nickel-ammonium sulphate is first dissolved in water, any free sulphuric acid neutralized by the careful addition of ammonia, until slightly alkaline, then the other constituents added. The bath should contain: water 100 gallons, double sulphate 55 pounds, sal ammoniac 5 pounds, common salt 3 pounds, boric acid 2 ounces, benzoic acid 1 ounce. The solution is used cold, but not below 60° F.; in summer, ice may be put into it. The deposit is so soft and tough that it can be burnished or the article spun.

J. W. RICHARDS.

**The Chemistry of Electroplating.** BY W. D. BANCROFT. *J. Franklin Inst.* August, 1905.—Principally a discussion of the chemistry of the electrolytic reactions occurring in plating, and especially of the chemical function of additions to the bath which redissolve metallic hydroxides and improve the deposits. Regarding size of crystals of metallic deposits, the author concludes that the greater the potential difference between metal and solution, the finer-grained the crystals. Addition of colloids to the solution makes the deposit more finely crystalline. The author acknowledges that he has no satisfactory explanation of the action of acids, oxidizing agents or reducing agents during electrolysis; he should have given the nearest to a satisfactory explanation that he himself could think of.

J. W. RICHARDS.

**The Borchers Furnace.** BY F. A. J. FITZGERALD. *Electrochemical and Metallurgical Industry*, June, 1905.—Describes the design and operation of a small incandescent carbon-rod electric furnace. A graphite rod may be assumed to have a resistivity of 0.00076 ohm (per centimeter cube), and thus for any rod the voltage may be calculated necessary to send 6 to 10 amperes of current through each square millimeter of its section. Quartz can be fused by a current furnishing 19 watts of energy per each square centimeter of resistor surface, running thirty minutes. The rod can be saw-toothed or notched, so as to increase its resistance length. Many practical knacks and useful information for designing and running such an experimental furnace are given.

J. W. RICHARDS.



## ORGANIC CHEMISTRY.

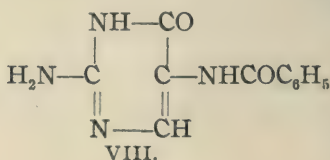
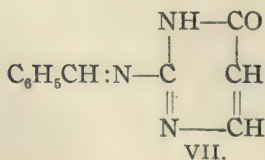
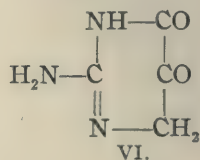
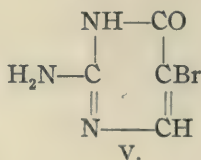
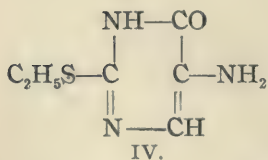
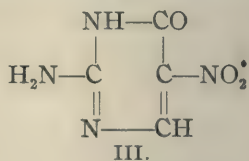
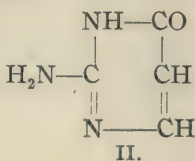
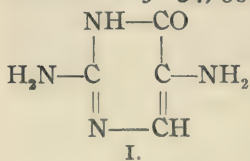
**The Action of Ethylene Dibromide on *p*-Nitrosodialkylanilines. II.** BY HENRY A. TORREY. *Am. Chem. J.* 34, 476-481. In a previous paper on this subject, the author showed that when *p*-nitrosodimethylaniline and ethylene dibromide interact at 80-90° there is formed a substance with the formula,  $(C_6H_4(NO)N(CH_3)_2)_2C_2H_2$ . One of the structural formulas then suggested

$$\begin{array}{c} \text{O} \qquad \qquad \text{O} \\ \diagdown \quad \diagup \quad \diagdown \quad \diagup \\ (CH_3)_2NC_6H_4N-CH-CH-NC_6H_4N(CH_3)_2 \end{array}$$

for this substance was  $(CH_3)_2NC_6H_4N-CHCH-NC_6H_4N(CH_3)_2$ . That this is the correct structure is now proved by its identity with the tetramethyldiaminoglyoxime-N-phenyl ether prepared by von Pechmann and Schmitz from *p*-nitrosodimethylaniline and diazomethane. Dilute nitric acid converts the glyoxime ether into tetramethyldiaminoglyoxaldianil,  $(CH_3)_2NC_6H_4N:CHCH:NC_6H_4N(CH_3)_2$ . The latter gives *p*-aminodimethylaniline when reduced by zinc and sulphuric acid; *o*-oxybenzylidene-*p*-aminodimethylphenylamine (m. p. 134-135°), when boiled with alcoholic salicylic aldehyde; and benzoyl-*p*-aminodimethylaniline, when treated with benzoyl chloride and dilute alkali. Ethylene dibromide and *p*-nitrosodiethylaniline react at ordinary temperatures with formation of the tetraethyldiaminoglyoxime-N-phenyl ether, identical with the product obtained by von Pechmann and Schmitz from *p*-nitrosodiethylaniline and diazomethane.

M. T. BOGERT.

**Researches on Pyrimidines. On 2,5-Diamino-6-Oxypyrimidine (Twelfth Paper).** BY TREAT B. JOHNSON AND CARL O. JOHNS. *Am. Chem. J.* 34, 554-568.—



Kutscher isolated from yeast nucleic acid a compound which he believes to be an oxydiaminopyrimidine. In the hope of obtaining this compound synthetically, the authors have prepared 2,5-diamino-6-oxypyrimidine (I). The two products, the natural and the synthetic, appear to be the same, although Kutscher's meagre description of his base renders the complete establishment of the identity of the two rather difficult. 2,5-Diamino-6-oxypyrimidine was prepared by three different methods: (1) Isocytosine (II) was nitrated in presence of strong sulphuric acid, and the nitro derivative reduced in ammoniacal solution with aluminum amalgam. (2) 2-Ethylmercapto-5-amino-6-oxypyrimidine (IV) was heated with alcoholic ammonia. (3) Bromisocytosine (V) was heated with concentrated aqueous ammonia. Of these three methods, the first is the only one of practical value for the production of the base. As stated above, this pyrimidine appears to be identical with Kutscher's base. Thus, it was not completely decomposed when heated with dilute sulphuric acid, but half the base was recovered unaltered, while part was hydrolyzed to 2-amino-5,6-dioxypyrimidine (VI). Of the oxydiaminopyrimidines investigated by the authors, it is the first one to show such stability towards sulphuric acid. EXPERIMENTAL.—2-Amino-5-nitro-6-oxypyrimidine (III), prepared by nitrating isocytosine (II) with a mixture of nitric and sulphuric acids, crystallizes from water in clusters of microscopic yellow prisms, insoluble in the ordinary organic solvents. At about  $280^{\circ}$  these crystals turn brown, but they do not decompose below  $300^{\circ}$ . When heated with 20 per cent. sulphuric acid for four hours at  $190$ – $200^{\circ}$ , the compound yielded nitrouracil. 2,5-Diamino-6-oxypyrimidine (I) was obtained from the above by suspending it in dilute ammonia water and adding aluminum amalgam. It crystallizes from water in large prisms, carrying a molecule of water. The anhydrous base has no definite melting-point, but decomposes at about  $245^{\circ}$ . It is extremely soluble in water, and is a strong diacid base, forming characteristic salts with hydrochloric, nitric and sulphuric acids. The hydrochloric and nitric acid salts are very easily soluble in water. The sulphate is difficultly soluble in water, and is the most characteristic derivative of the base so far obtained. The base is precipitated by phosphotungstic acid, mercuric chloride, or by potassiumbismuth iodide. Solutions of platinum or gold chlorides give no precipitates of double salts, but are slowly reduced to the metal. Photomicrographs are given of the crystals of the picrate, hydrochloride, nitrate and sulphate. The picrate,  $C_4H_8ON_4 \cdot C_6H_3O_7N_3$ , is very difficultly soluble. It crystallizes from water in short distorted prisms, or in stout needles, decomposing at  $250$ – $300^{\circ}$  according to the rate of heating. Dihydrochloride,  $C_4H_8ON_4 \cdot 2HCl, H_2O$ ; magnificent prismatic crystals, with tendency

to twin. *Nitrate*,  $C_4H_6ON_4 \cdot 2HNO_3$ ; beautiful prisms, exceedingly soluble in water. *Sulphate*,  $C_4H_6ON_4 \cdot H_2SO_4$ ; needles, or long slender prisms, not decomposing below  $300^\circ$ . *Behavior of 2,5-Diamino-6-oxypyrimidine when Heated with Sulphuric Acid under Pressure*.—When the diaminooxypyrimidine was heated with 20 per cent. sulphuric acid for three hours at  $130-140^\circ$ , half the base was recovered unaltered, part being hydrolyzed to 2-amino-5,6-dioxypyrimidine (VI). This experiment was of interest because Kutscher obtained his base by hydrolyzing yeast nucleic acid with sulphuric acid under pressure at high temperature. *2-Amino-5,6-dioxypyrimidine* (VI) crystallizes from water in microscopic prisms, which do not decompose below  $300^\circ$ . Its picrate forms microscopic prisms also, which char at  $240-250^\circ$ , but do not effervesce below  $280^\circ$ . *Action of Ammonia on Bromisocytosine*.—Bromisocytosine (V) was heated with excess of aqueous ammonia for six hours at  $190-215^\circ$ . The product was 2,5-diamino-6-oxypyrimidine (I). *Action of Ammonia on 2-Ethylmercapto-5-amino-6-oxypyrimidine*.—When 2-ethylmercapto-5-amino-6-oxypyrimidine (IV) and strong alcoholic ammonia were heated together for four hours at  $200-205^\circ$ , 2,5-diamino-6-oxypyrimidine (I) was formed. The same reaction could not be carried out with aqueous ammonia. *Hydrochloride of 2-Amino-5-benzoylamino-6-oxypyrimidine* (VIII), from guanidine and the sodium salt of ethyl formylhippurate, crystallizes from water in microscopic needles, which decompose with violent effervescence at about  $275^\circ$ . *2-Benzalamino-6-oxypyrimidine* (VII), from isocytosine (II) and benzaldehyde at  $160-180^\circ$ , is a yellow crystalline solid of both acid and weak basic properties, whose salts are dissociated by water. It is insoluble in water or alcohol, decomposes at  $238-242^\circ$ , and is remarkably stable towards nitric acid. *Action of Nitrous Acid on Isocytosine* (II).—Isocytosine does not react with nitrous acid. When the isocytosine was dissolved in acetic acid and sodium nitrite added, only an acetate was formed, and no nitroso derivative.

M. T. BOGERT.

**The Reaction between Organic Magnesium Compounds and Unsaturated Compounds. VII. Complex Products from Cinnamic Esters.** By E. P. KOHLER AND GERTRUDE HERITAGE. *Am. Chem. J.* **34**, 568-580.—It has frequently been pointed out by Kohler and his co-workers that the reaction between Grignard's reagent and unsaturated esters often leads to the formation of complex products derived from two molecules of the unsaturated compound. In the case of the cinnamic esters, the authors have now succeeded in separating a sufficient number of these complex products to show the general course of the reaction. A preliminary study of the action of phenylmagnesium bromide on phenyl  $\alpha$ -phenylcinnamate showed that the phenyl esters of un-



saturated acids react essentially the same as the alkyl esters. Phenyl cinnamate was therefore examined as to its behavior with the Grignard reagent, and it was found that when phenyl cinnamate was added to excess of carefully cooled, ethereal phenylmagnesium bromide, magnesium derivatives of phenyl diphenylpropionate and of diphenylpropiophenone resulted, according to the following equations:  $\text{C}_6\text{H}_5\text{CH}:\text{CHCOOC}_6\text{H}_5 + \text{C}_6\text{H}_5\text{MgBr} = (\text{C}_6\text{H}_5)_2\text{CHCH}:\text{C}(\text{OC}_6\text{H}_5)\text{OMgBr}$ ; and  $\text{C}_6\text{H}_5\text{CH}:\text{CHCOOC}_6\text{H}_5 + 2\text{C}_6\text{H}_5\text{MgBr} = (\text{C}_6\text{H}_5)_2\text{CHCH}:\text{C}(\text{C}_6\text{H}_5)\text{OMgBr} + \text{Mg}(\text{OC}_6\text{H}_5)\text{Br}$ ; and these are the substances which, by reacting with additional ester, subsequently form the complex compounds. If, instead of proceeding as above, the ethereal phenylmagnesium bromide was added to excess of carefully cooled ester, a  $\beta$ -ketonic ester resulted,  $(\text{C}_6\text{H}_5)_2\text{CHCH}(\text{COOC}_6\text{H}_5)\text{COCH}_2\text{CH}(\text{C}_6\text{H}_5)_2$ . The reaction between unsaturated esters and magnesium derivatives is hence quite different from that between sodium derivatives (for example, sodiomalonic ester) and the same esters. The reactions leading to the formation of the above  $\beta$ -ketonic ester are believed to be the following:  $(\text{C}_6\text{H}_5)_2\text{CHCH}:\text{C}(\text{OC}_6\text{H}_5)\text{OMgBr} + \text{C}_6\text{H}_5\text{OCOCH}:\text{CHC}_6\text{H}_5 = (\text{C}_6\text{H}_5)_2\text{CHCH}(\text{COOC}_6\text{H}_5)\text{COCH}:\text{CHC}_6\text{H}_5 + \text{MgBrOC}_6\text{H}_5$ ; and  $(\text{C}_6\text{H}_5)_2\text{CHCH}(\text{COOC}_6\text{H}_5)\text{COCH}:\text{CHC}_6\text{H}_5 + \text{C}_6\text{H}_5\text{MgBr} = (\text{C}_6\text{H}_5)_2\text{CHCH}(\text{COOC}_6\text{H}_5)\text{C}(\text{OMgBr})\text{CH}:\text{CH}(\text{C}_6\text{H}_5)_2$ . A second dimolecular product isolated in the course of the work proved to be a  $\beta$ -diketone of the structure  $(\text{C}_6\text{H}_5)_2\text{CHCH}(\text{COC}_6\text{H}_5)\text{COCH}_2\text{CH}(\text{C}_6\text{H}_5)_2$ , and is probably formed from the second primary product given above,  $(\text{C}_6\text{H}_5)_2\text{CHCH}:\text{C}(\text{OMgBr})\text{C}_6\text{H}_5$ , in a manner entirely similar to the formation of the  $\beta$ -ketonic ester from the first. Further treatment of this  $\beta$ -diketone with phenylmagnesium bromide gave the magnesium derivative of a tertiary alcohol,  $(\text{C}_6\text{H}_5)_2\text{CHCH}(\text{C}(\text{OH})(\text{C}_6\text{H}_5)_2)\text{COCH}_2\text{CH}(\text{C}_6\text{H}_5)_2$ .

EXPERIMENTAL.—(I) *Experiments with Phenyl  $\alpha$ -Phenylcinnamate*.—Phenyl  $\alpha$ -phenylcinnamate was made from the corresponding acid chloride and phenol. It crystallizes in stout needles, m. p.  $142^\circ$ , very sparingly soluble in alcohol or ether, moderately in acetone or benzene, readily in chloroform. While methyl phenylcinnamate reacts with only one molecule of phenylmagnesium bromide, the phenyl ester invariably reacts with two. *Triphenylpropiophenone*,  $(\text{C}_6\text{H}_5)_2\text{CHCH}(\text{C}_6\text{H}_5)\text{COC}_6\text{H}_5$ , prepared by hydrolyzing the magnesium derivative obtained from phenyl phenylcinnamate and phenylmagnesium bromide, crystallizes in small, colorless needles, m. p.  $182^\circ$ . Both the ketone and its magnesium derivative are relatively inert and stable. Like benzpinacolin, this ketone forms neither oxime nor hydrazone. (II) *Phenyl Cinnamate and Phenylmagnesium Bromide*. When an ethereal solution of the ester was added to an ethereal solution of phenylmagnesium bromide at low temperature, and the product decomposed with

iced hydrochloric acid, there was formed mainly diphenylpropionic acid and diphenylpropiophenone, together with a small amount of diphenyl. If, however, the reacting substances were mixed in the reverse order, the phenylmagnesium bromide being added to the ester, the result was quite different. When one molecule of the bromide was used to two of the ester, upon decomposition of the magnesium compound a yellow oil was obtained which consisted mainly of *triphenylpentenone*,  $(C_6H_5)_2CHCH_2COCH:CHC_6H_5$ . With equimolecular amounts of the bromide and ester, there was obtained a  $\beta$ -ketonic ester,  $(C_6H_5)_2CHCH(COOC_6H_5)COCH_2CH(C_6H_5)_2$ , which crystallized from a mixture of chloroform and absolute alcohol in long needles, m. p.  $180-182^\circ$ . Boiled with alcoholic potassium hydroxide solution, it was readily hydrolyzed to tetraphenylpentanone, phenol and carbon dioxide. *Tetraphenylpentanone*,  $(C_6H_5)_2CHCH_2COCH_2CH(C_6H_5)_2$ , crystallizes from absolute alcohol in colorless needles, m. p.  $130^\circ$ . Its *oxime* separates from alcohol in needles, m. p.  $115-116^\circ$ . Rearranged by the Beckmann reaction, it yielded an *amide* of the structure  $(C_6H_5)_2CHCH_2CONHCH_2CH(C_6H_5)_2$ , which crystallized from absolute alcohol in small lustrous prisms, m. p.  $155^\circ$ . *Methyl Cinnamate and Phenylmagnesium Bromide*.—By adding phenylmagnesium bromide very slowly to a carefully cooled solution of the ester, the methyl ester of a  $\beta$ -ketonic acid was obtained which corresponded entirely to the ester obtained with phenyl cinnamate under the same conditions. Its structure is therefore  $(C_6H_5)_2CHCH(COOC_6H_5)COCH_2CH(C_6H_5)_2$ . It crystallizes from a mixture of chloroform and alcohol in fine needles, m. p.  $211-213^\circ$ , and breaks down into two molecules of diphenylpropionic acid when heated with concentrated hydrochloric acid at  $200^\circ$ . *Benzoyltetraphenylpentanone*,  $(C_6H_5)_2CHCH(COC_6H_5)COCH_2CH(C_6H_5)_2$ , was obtained in nearly all the experiments with the cinnamic esters. It crystallizes from a mixture of acetone and alcohol in needles, m. p.  $166^\circ$ . On hydrolysis, it yields either tetraphenylpentanone and benzoic acid, or diphenylpropiophenone and diphenylpropionic acid. When the cinnamic ester and the Grignard reagent were boiled together for several hours before decomposing with ice water, still more complex substances were formed. From the mixture thus produced, a *tertiary alcohol* was separated, of the formula  $(C_6H_5)_2CHCH(COCH_2CH(C_6H_5)_2)C(C_6H_5)_2OH$ . It melts at  $153^\circ$ , and breaks up into benzophenone and tetraphenylpentanone when heated with concentrated hydrochloric acid at  $200^\circ$ , or when heated alone at  $270-300^\circ$ .

M. T. BOGERT.

**On the Composition of Petroleum.** BY CHAS. F. MABERY. **The Sulphur Compounds and Unsaturated Hydrocarbons in Canadian Petroleum.** BY CHAS. F. MABERY AND WILLIAM O.

QUAYLE. *Proc. Am. Acad.* **41**, 89-113. — Having established by a preliminary investigation the fact that the sulphur compounds and unsaturated hydrocarbons of petroleum are present as such in the original oil, and are not alteration products incident to the process of refining, the authors undertook the examination of a crude sulphur oil from Canadian burning oil. The oil was first fractioned repeatedly at 50 mm. pressure, the lowest fractions being finally rectified at ordinary pressure. All the fractions were colorless when first collected, but turned dark red on standing. Those boiling below  $125^{\circ}$  at 50 mm. were quite unstable, and on long standing deposited dark heavy oils. All the final fractions appeared to be mixtures of an unsaturated hydrocarbon, another hydrocarbon of an undetermined series, and a sulphur compound. The sulphur compound was precipitated as a viscous oil by shaking the fraction with excess of alcoholic mercuric chloride solution. The precipitate was washed with alcohol and very volatile gasoline, decomposed with hydrogen sulphide in presence of alcohol, the mercury sulphide filtered out, and the oil separated by largely diluting the filtrate. After a repetition of this purification with mercuric chloride, the oil obtained was carefully fractioned under diminished pressure until it boiled for the most part within  $1^{\circ}$  or  $2^{\circ}$ . The sulphur compounds thus obtained belong to a series  $C_nH_{2n}S$ , different from any hitherto described, and the authors propose for them the name "thiophane." The sulphur compound separated from the fraction boiling at  $40-50^{\circ}$  at 50 mm., on analysis gave figures agreeing fairly well with the formula  $C_6H_{12}S$ , and had a boiling-point of  $125-130^{\circ}$ . As the larger part of this sulphur oil was accidentally lost, closer fractioning could not be carried out. *Heptylthiophane*,  $C_7H_{14}S$ , from the fraction boiling at  $71-73^{\circ}$  at 50 mm., is an oil which boils at  $74-76^{\circ}$  at 50 mm.;  $158-160^{\circ}$  at 750 mm.; sp. gr. at  $20^{\circ}$ , 0.8878. *Octylthiophane*,  $C_8H_{16}S$ , from the fraction boiling at  $79-81^{\circ}$  at 50 mm., is an oil which boils at  $81-83^{\circ}$  at 50 mm.;  $167-169^{\circ}$  at ordinary pressure; sp. gr. at  $20^{\circ}$ , 0.8929. *Isooctylthiophane*,  $C_8H_{16}S$ , from the fraction boiling at  $97-99^{\circ}$  at 50 mm.; b. p.  $94-96^{\circ}$  at 50 mm.;  $183-185^{\circ}$  at ordinary pressure (with some decomposition); sp. gr. at  $20^{\circ}$ , 0.8937. *Nonylthiophane*,  $C_9H_{18}S$ , from the fraction boiling at  $106-108^{\circ}$  at 50 mm.; b. p.  $106-108^{\circ}$  at 50 mm.;  $193-195^{\circ}$  at ordinary pressure; sp. gr. at  $20^{\circ}$ , 0.8997. *Decylthiophane*,  $C_{10}H_{20}S$ , from the fraction boiling at  $114-115^{\circ}$  at 50 mm.; b. p.  $114-116^{\circ}$  at 50 mm.;  $206-209^{\circ}$  at 750 mm.; sp. gr. at  $20^{\circ}$ , 0.9074. *Undecylthiophane*,  $C_{11}H_{22}S$ , from the fraction boiling at  $135-145^{\circ}$  at 50 mm.; b. p.  $128-130^{\circ}$  at 50 mm.; sp. gr. at  $20^{\circ}$ , 0.9147. *Quatdecylthiophane*,  $C_{14}H_{28}S$ , from the fraction boiling at  $160-170^{\circ}$  at 50 mm.; b. p.  $168-170^{\circ}$  at 50 mm.;  $266-268^{\circ}$  at 750 mm.; sp. gr. at  $20^{\circ}$ , 0.9208. *Sexdecylthiophane*,  $C_{16}H_{32}S$ , from the fraction boiling at  $170-180^{\circ}$  at 50 mm.; b. p.  $184-$



186° at 50 mm.; 283–285° at 750 mm. (with some decomposition); sp. gr. at 20°, 0.9222. *Octodecylthiophane*,  $C_{18}H_{36}S$ , from the fraction boiling at 190–210° at 50 mm.; b. p. 198–202° at 50 mm.; 290–295° at ordinary pressure (with some decomposition); sp. gr. at 20°, 0.9235. The thiophanes combine readily with alcoholic mercuric chloride to form viscous oils. They also form addition products with chlorplatinic acid, which are heavy viscous oils. Heated with ethyl iodide in sealed tubes, they form addition products,  $C_nH_{2n}S.C_2H_5I$ , which crystallize in small prisms, and yield alkaline hydroxides when warmed with silver oxide and water. They combine with bromine with almost explosive violence, the amount of hydrogen bromide evolved being equivalent to the amount of bromine taken up. By oxidation they are changed to sulphones.

*Indices of Refraction of the Thiophanes.*—Heptyl, 1.468; octyl, 1.4870; nonyl, 1.4746; decyl, 1.4766; undecyl, 1.480; quatdecyl, 1.4892; sexdecyl, 1.4903; octodecyl, 1.4977.

*Oxidation Products of the Thiophanes.*—By oxidizing the thiophanes with potassium permanganate, sulphones were obtained as heavy viscous oils. *Hexylthiophanesulphone*,  $C_6H_{12}SO_2$ .—The fraction boiling at 55–57° at 50 mm. was oxidized with potassium permanganate, and gave a thick viscous oil, of sweetish taste and odor, whose analysis indicated that hexylthiophanesulphone was its chief constituent. *Heptylthiophanesulphone*, very thick, heavy oil; sp. gr. at 20°, 1.1138. *Octylthiophanesulphone*, heavy oil; sp. gr. at 20°, 1.1142. *Nonylthiophanesulphone*, heavy oil; sp. gr. at 20°, 1.1161. *Undecylthiophanesulphone*, heavy oil; sp. gr. at 20°, 1.1126. *Dodecylthiophanesulphone*, heavy oil; sp. gr. at 20°, 1.1372. It appears likely that the thiophanes are polymethylene sulphides.

*Unsaturated Hydrocarbons of the Series  $C_nH_{2n}$ .*—Up to the present time, the literature contains no satisfactory proof of the presence of ethylene hydrocarbons in petroleum. By extracting the burning oil fraction from the Canadian petroleum with sulphuric acid, the unsaturated hydrocarbons and sulphur compounds were removed, and were subsequently recovered from the sludge by diluting. The sludge oil separated was then repeatedly fractioned. The fractions were shown to contain unsaturated hydrocarbons, and also small amounts of sulphur compounds of a different series from those described above as thiophanes. The percentage of ethylenes found was very small. The fractions united with bromine with explosive violence, but the resultant bromine addition products were too unstable to purify. The composition of these unsaturated hydrocarbons was therefore determined by adding hydrogen bromide which, being without action upon the sulphur compounds, obviated the necessity of removing the latter. *Hexylene*.—The fraction boiling at 70–80° was heated five hours at 120° with concentrated hydrobromic acid. The product, washed, dried, and fractioned *in vacuo*, boiled for the most part at 62–65° at

50 mm. and, on analysis, gave figures indicating the presence of hexyl bromide. *Heptylene*.—The fraction boiling at  $98-102^{\circ}$ , with hydrobromic acid, gave a heptyl bromide, b. p.  $76-80^{\circ}$  at 50 mm., sp. gr. 1.1601. *Octylene*.—The octyl bromide obtained from the fraction boiling at  $118-119^{\circ}$  had a boiling-point of  $93-95^{\circ}$  at 50 mm., and a specific gravity of 1.1836. *Nonylene*.—The fraction boiling at  $140-141^{\circ}$  yielded a nonyl bromide, b. p.  $110-113^{\circ}$  at 50 mm., sp. gr. 1.2084. Canadian petroleum also contains certain sulphur-free oils, soluble in alcohol and differing in various respects from the series hitherto identified in petroleum, and which may possibly be terpenes. M. T. BOGERT.

**The Constitution of Quinine.** BY BENJAMIN LINDLEY MURRAY. *School of Mines Quart.* 27, 39-60.—A digest of the literature of the subject to date, together with some experiments on quitenine and quitenol. EXPERIMENTAL.—In preparing quitenine by the oxidation of quinine sulphate with potassium permanganate, it was found that the best way to extract the quitenine from the precipitated manganese oxides was to boil with 5 per cent. sodium hydroxide solution, filter, and then neutralize with the exact amount of sulphuric acid or with an excess of boric acid. The separation of quitenine is then practically quantitative. The quantity of quitenine produced by the oxidation amounted to 43.3 per cent. of the theoretical. It was purified by dissolving in ammonia, reprecipitating with carbon dioxide, repeating this process two or three times, and finally crystallizing from dilute alcohol. It is insoluble in most of the ordinary organic solvents, except pyridine and phenol, but is soluble in acids or alkalies. Beautiful long needles were obtained by crystallizing from dilute phenol, consisting of a *double salt* of quitenine and phenol, and containing water of crystallization. These crystals melt with decomposition at  $238-245^{\circ}$ , or at  $243^{\circ}$  if heated quickly. A similar double salt was obtained with *o*-cresol. By reducing quitenine with hydriodic acid, quitenol was prepared. It forms needle-shaped crystals, soluble in acids, alkalies or hot alcohol; practically insoluble in cold alcohol, water or ether.

M. T. BOGERT.

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## INDUSTRIAL CHEMISTRY.

**The Chemical Industries of the Dominion.** BY W. R. LANG, D.Sc. *Trans. of the Canada Inst.*—The industrial development has been very great in recent years as is shown in this paper. The subjects treated are: I, Common Salt and Alkali; II, The Extraction and Refining of Metals; III, The Manufacture of Leather; IV, Sulphuric and Acetic Acids, Wood Alcohol, Charcoal and Ammonia; V, Soap and Glycerine; VI, Refined Chemicals

and Drugs; VII, Fertilizers; VIII, Coal Tar and Asphalt; IX, Calcium Carbide, Carborundum, Corundum, and Graphite; X, Cement and Plaster; XI, The Beet Sugar Industry; XII, Natural Gas and Petroleum; XIII, Pulp and Paper; XIV, Asbestos and Mica.

(I) At Goderich, Ontario, there is a salt deposit 126 feet thick, and at Windsor, a well of 1,672 feet passes through four beds with a total thickness of 392 feet. The natural product at Goderich is 99.687 per cent. pure. The total production in 1903 amounted to \$334,000, and besides domestic use and as a preservative, it is used for the manufacture of alkali.

(II) The extraction and refining of metals is carried on extensively. Iron, copper, lead, silver, nickel, arsenic, antimony and aluminum are produced in large quantities from the following ores: native iron, magnetic iron ore, pyrites, haematite, native copper, chalcopyrite, galena, native silver and ores, nickeliferous pyrrhotite (gold), antimony sulphide and arsenical pyrites. Iron and steel are produced at Sault Ste. Marie, Collingwood and Midland, Ontario, also in Cape Breton, Nova Scotia, and Newfoundland. In most cases limestone is quarried on the property.

*Copper* is produced by the British Columbia Copper Co. to the extent of about 7,000,000 pounds per year for  $9\frac{1}{2}$  cents per pound. The Montreal and Boston Copper Co. produces about 3,000,000 pounds per year and the Granby Co. 15,000,000 at  $9\frac{1}{2}$  cents laid down in New York.

Interesting ores are described by Mr. A. P. Turner, of the Canadian Copper Co., found in the territory extending from Garson Township in the District of Nipissing, to Drury Township in the District of Algoma. About 700 tons of ore are mined and smelted per day. The ore is a mixture of nickeliferous pyrrhotite, pentlandite, chalcopyrite and diorite. The nickel in the pyrrhotite replaces about 4 per cent. of the iron. The ore contains no arsenic or antimony, but small traces of gold, platinum and palladium.

The *nickel* from the Sudbury ore is smelted with the copper and sent to Wales, where it is refined. A large part of the nickel ore is sent in the form of mattes to the Orford Copper Company's works at Constable Hook, N. J. and refined by the alkaline sulphide process.

*Aluminum* is produced by the Northern Aluminum Co., using the Hall process. The bauxite is heated with carbon, which reduces iron and titanium, and these together with silica are slagged off, leaving pure alumina.

*Lead and Silver*.—The British Columbia silver-bearing galena carries 25 to 300 ounces of silver to the ton.

*Arsenic*.—Both arsenic and gold are obtained from arsenical pyrites (mispickel). The gold is extracted by means of amalgamation and leaching and the arsenic sublimed. The output of



arsenic increased from 113,477 pounds in 1899, to 1,347,000 pounds in 1901.

*Antimony*.—Like the arsenic, this metal occurs associated with gold.

(III) The manufacture of leather. Bark, chrome, and combination tannages are employed.

(IV) The sulphuric acid manufacture has not developed very far. What is produced goes to oil refiners.

Sulphites, bisulphites, crude acetic acid, chloride of zinc and Glauber's salts are made.

Considerable wood alcohol, charcoal and the various products from wood are made.

More ammonia is produced than is required for home consumption.

(V) *Soap and Glycerol*.—Cocoanut oil, palm oil and tallow are most largely used. In 1902 there was \$9,000,000 worth produced. Glycerol is extensively separated from the lyes.

(VI) *Refined Chemicals and Drugs*.—There are relatively few makers of refined chemicals. Among the articles produced are thiosulphates, bisulphites, liquid carbon dioxide, zinc salts, iodides, bromides, etc.

(VII) *Fertilizers*.—This industry has been handicapped by the cheap mining of the phosphates in the Carolinas and Florida. Phosphates, sulphate of ammonia, offal, fish, blood, etc., are used, however, for fertilizers.

(VIII) *Coal Tar and Asphalt*.—Very little coal tar is distilled. The tar produced in the gas works is too thick. The distillation of coke-oven tar has been more successful.

(IX) *Calcium Carbide* is made extensively by the Ottawa Carbide Co., and the Shawinigan Carbide Co. In Ontario several towns are lit by acetylene.

(X) *Cement and Plaster Industry*.—There are eight companies manufacturing cement in Ontario. Clay and marl are mixed as a slurry and are fed wet into the rotary kilns. Considerable gypsum is mined and calcined to plaster of Paris.

(XI) *Carbohydrates*.—Beet-sugar has not been very successfully produced. A plentiful supply of water, lime, and water-power are requisites for its manufacture.

(XII) *Petroleum*.—The production of this product is apparently falling off, due to no new territory being developed and the old wells not being so productive.

(XIII) *Pulp and Paper* are very promising industries, \$5,000,000 worth of pulp having been exported in 1903.

S. P. SADTLER.

**Fire Tests with Concrete and Reinforced Concrete.** *Am. Gas Light Journal*, December 11, 1905.—The cement aggregates used in the insulation tests were all 5:1 mixtures, as follows:

(1) Furnace slag	3,	sand	2,	and cement	1
(2) Broken brick	3,	"	2,	"	1
(3) " granite	3,	"	2,	"	1
(4) Furnace clinker	3,	"	2,	"	1
(5) Thames ballast	3,	"	2,	"	1
(6) Burned ballast	5,		"	"	1
(7) Coke breeze	5,		"	"	1

Nos. 4 and 7 seemed to give the best results.

S. P. SADTLER.

**Dry Milk.** BY WILLIAM BOOTH, B. S. *Chem. Eng.*, October, 1905.—In discussing the subject of dry milk, the author refers to the great importance of having a food product for more ready transportation. Very interesting statistics are given with regard to the total production, the entire production of milk being over 61,000,000,000 pounds per year.

Various dry products of milk contain some of the food products, but none, with the exception of recent attempts at evaporating milk, contain all.

A great difficulty in evaporating milk is that if the temperature exceeds 60° C., and even that figure is rather high, the water of the milk-sugar is eliminated, and the proteids become insoluble. The temperature of 38° C. is even given as one that should preferably not be exceeded.

In cold countries a method of concentration by freezing has been tried, with interesting results, as shown by the following analysis:

	Ice.	Residual liquid.
Water.....	96.23	88.82
Fat.....	1.23	4.73
Sugar.....	1.42	4.95
Proteids.....	0.91	3.00
Ash.....	0.21	0.80
Density.....	1009.00	1034.5

This concentration is furthermore improved by centrifugal treatment.

Evaporation is very much easier where the milk is absorbed in some dry material, such as rolled oats or cracker dust, in which the absorbing material is about 50 per cent. of the finished product.

Of the patented processes, those mentioned are the Campbell process, the Just process and the Ekenberg process, which are all more or less dependent upon a skim of milk forming upon a rotating heated roller.

In the Just process, the temperature is greater on one roller, even exceeding that of the boiling-point of water by 10° or 20°, which is, however, for a very brief time, and it is said that a layer of steam separates the milk promptly from the roller. This process is in active operation in various points in Europe and in this country, the products containing 26, 20, and 10 per cent. of pure butter fat, while products are also made from skimmed milk containing less.

The Ekenberg process is provided with a vacuum, which enables the work to be done at temperatures from 38° to 60° C. The product is soluble and palatable. Nine-tenths of a pound of exhaust steam is required for each pound of milk.

S. P. SADTLER.

**An Apparatus for Effecting Rapid Solution.** BY ROBERT JOB. *Chem. Eng.* October, 1905.—The author uses compressed air which is purified by passing through a jar of water, to collect any dust or oil that may occur in the air, and shows several methods of stirring with the use of this apparatus. For stirring steel drillings in double chloride of copper and potassium, the drillings are in V-shaped jars, with the tubes carrying the compressed air running down to the bottom. For stirring phosphomolybdate precipitates, the tubes run into Erlenmeyer flasks. The precipitation is effected by this in about five minutes.

S. P. SADTLER.

**The Use of Dissolved Acetylene.** *Am. Gas Light Journal*, December 18, 1905.—This article is based upon a paper read by Herr Kuchel before the German Acetylene Association, and another entitled "Compressed Acetylene," read before the International Acetylene Association by Eugene Bournonville.

Acetylene is dissolved at a pressure of from 10 to 12 atmospheres in acetone, which is held in cylinders packed with porous material such as asbestos, compacted with a little silicate of soda, or charcoal with a similar cementing agent.

Acetone holds 250 volumes of acetylene at 10 atmospheres and 300 volumes at 12 atmospheres. Impurities, especially water, have a deleterious effect upon the solution of the gas. These impurities, furthermore, accumulate, as the acetylene in passing off carries with it acetone vapor.

The acetylene causes the acetone to expand. When saturated at 12 atmospheres the expansion is 50 per cent.

For train lighting this system has extensive application.

Comparison of methods for train lighting:

	Hours of light.	Weight in pounds.	Space occupied in cubic feet.
German oil gas, at 4.77-candle power per foot	96.15	12.0	0.47
British oil gas, at 8-candle power per foot.....	161.7	7.1	0.28
Electricity from accumulators.....	144.0	6.1	0.06
Acetylene oil gas, at 11.8-candle power per foot	238.1	4.8	0.19
Dissolved acetylene, at 35.5-candle power per foot.....	357.14	0.53	0.005

The cost is compared with the Pintsch gas as follows:

	Candle-power.	Cents per hour.
Pintsch gas.....	180	9.9
Dissolved acetylene.....	180	2.84

S. P. SADTLER.



**The Manufacture of Coke in Northern China.** BY YANG TSANG WOO, Tong Shan, China. *Trans. Am. Inst. Min. Eng.* November, 1905.—The process described in this article is very similar to the bee-hive oven process of the United States. The kiln, however, has permanent sides, which go somewhat more than half way up the pile. The coal is piled with radiating flues from a central draft chimney, which runs a little below the center of the pile downward to a little below the flue. The radial flues are 9 in number.

The total diameter of the kiln, measured from the inside of the retaining wall, is 13 feet, and about  $8\frac{1}{2}$  feet from the bottom of the pile to the top.

When the operation of coking is under way, any opening that gives out gas or flame is closed by means of earth. When all the gases have escaped, water is poured on to quench the fire. Each charge of  $22\frac{1}{2}$  tons of washed coal yields 10 tons of good coke and one ton of ashes. The price of the coal dust used at the pit-mouth is \$4.50 (Mex.) per ton, and the coke sells at \$18 to \$20 per ton (Mex.).

S. P. SADTLER.

**A Brief Outline of Gas Works Chemistry.** BY H. B. HARROP, B.Sc., M.D. *Chem. Eng.* October, 1905.

*Ammonia.*—The compounds obtained from the ammonia liquor as separated in the mains, condensers and scrubbers, are, ammonium carbonate, ammonium sulphide, ammonium cyanide, ammonium sulphate, ammonium chloride, ammonium sulphocyanate, ammonium ferrocyanide, with various other compounds, such as phenols, benzenes, naphthalene and tarry matters. Carbonates, sulphides and cyanides are commonly called volatile ammonia compounds. The cyanide is troublesome because of its attack upon pipes and fittings, unless removed at an early stage, while the carbonate forms stoppages in the concentrator.

The author describes the rather customary methods of distillation of the ammonias in a very concise way, and then explains the English system of rating ammonia liquor in terms of ounce strength. This refers to the number of ounces of actual sulphuric acid, by weight, required to saturate the ammonia contained in each gallon of liquor.

The fixed ammonia in a sample may be determined without flask or condenser by titrating with normal sodium hydroxide after boiling. The difference between the amount taken and that remaining gives the fixed ammonia. The free ammonia in another sample is then obtained by direct titration with acid. The percentage of ammonia by weight is most generally used now, instead of ounce strength notation.

For quick, approximate work, a titration of 1 cc. is frequently made, and the amount of fixed ammonia allowed for, as it is

fairly constant, and is verified from time to time by more complete analysis.

Some ammonia runs to waste after distillation. The author states that it should never be more than 1 in 100, and can be made less than 1 in 200. The amount of ammonia obtained from Pittsburg coal can be from 5 to  $5\frac{1}{2}$  pounds per net ton, but  $4\frac{1}{2}$  pounds is more nearly the average result.

*Cyanogen and Minor Residuals.*—Various methods that have been proposed for getting out the cyanogen, by making ferrocyanide, are described. The author, however, states that an economical method is not likely to be obtained until its removal is dependent upon the formation of an alkaline cyanide. The utilizing of spent oxide is carried out only for extracting cyanide, the extraction of the sulphur not being remunerative.

S. P. SADTLER.

**The Products of the Distillation of Pine Wood.** BY WM. H. WALKER, ELMER W. WIGGINS AND EDWARD C. SMITH. *Tech. Quarterly*, September, 1905.—The process, carried out experimentally in the laboratory of the Massachusetts Institute of Technology, consists in the use of a retort made from 12-inch wrought iron pipe, surrounded by a 14-inch pipe which serves as a jacket, the two sections of pipe being held in place by caps, which space them and form the ends of the retort. Superheated steam passes through both the jacket, so made, and the interior of the charge, which is put in the pipe from one end, which is removable. The superheater consists of a coil of  $\frac{3}{4}$ -inch wrought iron pipe, heated in a gas furnace supplied with a blast. A condenser is connected to the delivery pipe.

The entering steam was superheated up to  $400^{\circ}\text{C}.$ , although the distillation was started at lower temperatures. The best conditions for both the obtaining of turpentine and rosin were an initial temperature of  $175^{\circ}\text{C}.$ , with the temperature finally brought up to  $400^{\circ}\text{C}.$  If the temperature is not quickly brought up to  $170^{\circ}$ , the oil comes over slowly, and will ultimately cease to distil unless the temperature is raised. If the temperature in the initial portion of the run is above  $200^{\circ}\text{C}.$ , the yield is not improved, and the turpentine is discolored and has a burnt odor. It was found that heart-wood was of little value for the production of turpentine as compared with stump-wood. The turpentine or clear oil obtained was fractioned with the following results, 80 per cent. coming over below  $163^{\circ}\text{C}.$  and over 90 per cent. coming over below  $175^{\circ}\text{C}.$  The chief constituent of this oil is probably pinene,  $\text{C}_{10}\text{H}_{16}$ . The specific gravity averages 0.865 to 0.867. Examined with a polariscope, it showed a specific rotatory power of  $28.7^{\circ}$ .

Very little free acid was found in the turpentine, while 7 per cent. of esters, calculated as bornyl acetate, were found, as com-

pared with 1.44 in a sample of commercial turpentine tested at the same time.

The test for the amount of non-volatile matter, when allowed to evaporate upon a watch-glass, was very close to that of commercial turpentine, it averaging less than 1 per cent.

The crude rosin was heated for three-quarters of an hour at a temperature of 150° C. to drive off the moisture, after which it solidified to a hard mass with clear vitreous fracture, and of almost black color. Owing to the color, the rosin was of little value, so experiments were conducted to convert it into rosin oil. The results were very close to those obtained with ordinary rosin, as the following table will show:

Products.	Weight. Grams.	Yield. Per cent.	Sp. gr.
Acid liquor.....	87	15.34	.....
Rosin spirit.....	73	4.49	0.930
Rosin oil.....	430	26.47	0.990
Blue oil.....	291	17.91	0.994
Green oil.....	270	16.62	1.030
Tar..	75	4.62	.....

After steam distillation of the wood, dry distillation was carried out. The first run was made at a temperature of 300° C. for two hours. This was done in a cast iron retort with a direct coil condenser attached.

The pyroligneous acid and tar were of the usual kind, while the charcoal was dense and hard.

In the last three runs, the retort was heated slowly to 175° C., and held there for one hour, after which it was raised to above 300°.

Run.	Weight of wood. Kilograms.	Gas. Per cent.	Crude product. Per cent.	Tar. Per cent.	50 per cent. acid. Per cent.	Oil. Per cent.	Charcoal. Per cent.
I .....	2.2	43.0	34.2	19.5	1.18	3.0	23.9
II.....	2.0	28.7	46.9	25.9	1.70	2.5	24.5
III.....	2.0	25.9	39.6	19.8	1.32	2.6	34.5
IV.....	2.0	24.1	51.4	26.8	1.86	3.6	23.3

The following summary gives the results of the distillation of the tar:

	Grams.
Weight of tar treated.....	360
Weight of acid and water.....	24
Weight of oils.....	140
Weight of creosote in oils.....	32
Weight of solid residue in still.....	196

The yields calculated to a cord of light wood of 6,000 pounds are then given as follows:

From steam distillation:

Product.	Amount.	Yield. Per cent.
Turpentine.....	24.9 gallons	3.0
Yellow oil .....	4.4 "	0.56
Rosin .....	318 pounds	5.3



## From distillation of rosin:

Product.	Amount.	Yield. Per cent.
Rosin spirit.....	2.5 gallons	0.3
Rosin oil.....	10.9 "	1.5
Blue oil.....	7.25 "	1.0
Green oil.....	5.6 "	0.8
Pitch.....	12 pounds	0.2

## From dry distillation of wood:

Gray acetate of lime.....	46.2 pounds	...
Light oil.....	18.4 gallons	2.34
Charcoal.....	1,050 pounds	17.5
Gas.....	3,750 cu. ft.	2.0
Wood tar.....	1,217 pounds	20.28

## From distillation of wood tar:

Creosote oil (15 per cent.)	306 "	5.1
Wood pitch.....	516 "	8.6

## From creosote oil:

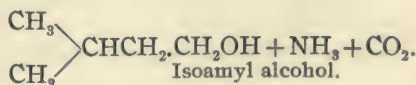
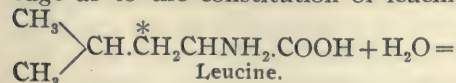
Creosote.....	45.9 "	0.76
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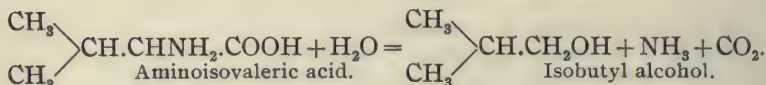
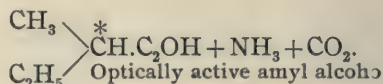
In conclusion the authors state that the experiments indicate that a turpentine can be obtained from light wood by steam distillation, and that this turpentine is equal in every way to the present commercial article, with the exception of a slightly different odor. The authors further believe that they have demonstrated that there is in the waste stumps, roots and trunks of the long leaf-pine, enough material to supply large quantities of naval stores hitherto unappreciated. S. P. SADTLER.

**On the Origin of Fusel Oil in Spirits.** BY SAMUEL P. SADTLER, PH.D. *Chem. Eng.* November, 1905.—In this paper, reference is made to the fact that Dr. Felix Ehrlich, of Berlin, has solved the very interesting problem as to the origin of fusel oil in spirits, has shown the fallacies of the theory that it had come from the fermentation of the sugars, and conclusively shown that fusel oil is produced from the products of decomposition of proteid matter, such as amino acids, the action being dependent upon the yeast itself, and not upon bacteria, as had been heretofore supposed.

The material used by Dr. Ehrlich for his experiments was isoleucine, which was obtained from the last residues of the production of sugar, by the strontian process, and which he subsequently recognized as a most important product of decomposition occurring along with leucine in all albuminoids.

The following reactions are written, based upon the best knowledge as to the constitution of leucine and isoleucine.





Although these products come from amino acids, sugar is necessary as additional food for the yeasts, and the proper proportions between the leucine and the sugar, or between the proteids which break down into the amino acids in the sugar, are necessary. It was found that by regular additions of leucine and isoleucine, corresponding additional amounts of amyl and isobutyl alcohols were formed.

Besides the formation of leucine in the strontian sugar extraction process, it is also found in the waste liquors from starch and glue manufacture and in horn and blood waste products.

S. P. SADTLER.

**Note on the Manufacture of Portland Cement.** *Chem. Eng.* November, 1905.—A. F. LeChatelier, in French patent No. 351, 821, proposes to add certain quantities of lime, silica and iron and aluminum oxides to the blast-furnace slag, in order that the slag may be readily made into Portland cement. It does not refer to the fusibility of the slag.

S. P. SADTLER.

**Cost of Electric Power.** *Chem. Eng.* November, 1905.—It is here stated that while the average power station does not get percentage load factors better than 15 to 30 per cent., in electro-chemical work 100 per cent. may be obtained. By the use of steam, a figure of \$30 to \$40 per horse-power year is said to be easily obtainable, while with producer gas it may be brought down to \$20. The cost of electrical energy at Niagara Falls varies between \$17.50 and \$20.75 per horse-power year. No figures are given for the cost with the use of blast-furnace gas.

S. P. SADTLER.

**The Valuation of Lubricating Oils.** *Chem. Eng.* November, 1905.—The very large amount of energy that is expended in overcoming friction is here pointed out, it being claimed that from 40 to 80 per cent. of the fuel used is required to overcome friction. Figures are given, showing the large differences in an actual test that were obtained by the use of different lubricating oils.

Friction is caused by minute projections on all surfaces, and the lubricating oil is used to keep these apart, and to prevent their interlocking. An important consideration is the friction

between particles of the oils themselves, which, as both surfaces become covered with oil, is then due to oil upon oil. The two are opposite to each other, and the oil that tends best to keep the surfaces apart has the greatest internal friction, so that careful work is necessary to balance these two factors.

The tests stated as necessary for a good lubricating oil, are as follows:

(1) *Viscosity Test*.—It must be sufficiently viscous, as has been said before, to keep the surfaces apart, and at the same time it must not be so much so as to create unnecessary fluid friction in the oil itself, or as to cause it not to flow readily between the two surfaces.

(2) *Cold Test*.—It must not solidify or congeal at the temperatures at which the machinery is run.

(3) *Flash and Fire Test*.—It must not give off inflammable or explosive vapors, nor take fire when exposed to moderate heat.

(4) *Corrosion Test*.—It must contain no acid nor form any on exposure or use, since this would corrode the bearing.

(5) *Oxidation Test*.—It must not dry or gum (oxidize) when exposed to the air, as this would of itself make the bearing run hard.

Vegetable oils are particularly useful for cylinder purposes, as they stick well to the metal, even when wet. Troublesome properties are the formation of rancidity and becoming thick and gummy.

The maximum allowable amount of free acid in cylinder oils is about 3 per cent., and for mineral acid 0.3 per cent.

The action of oil upon metals can be tested in a practical way by putting in bright strips of copper or iron which have been previously weighed. Differences in the weight may be noticed after some days, and more particularly the appearance of the surfaces.

S. P. SADTLER.

**Method of Sampling Coal Seams to Determine the Chemical Composition and Calorific Value of the Coal.** BY M. R. CAMPBELL. *Chem. Eng.* November 1905. The four most important provisions taken from Bulletin 5, page 106, of the American Institute of Mining Engineers, are here given:

(1) Select a fresh face of coal, and clean it of all powder-stains and other impurities.

(2) Cut a channel perpendicularly across the face of the coal from roof to floor, with the exceptions noted in 3, of such a size as to yield at least 5 pounds of coal per foot of thickness of coal bed; that is, 5 pounds for a bed 1 foot thick, 10 pounds for a bed 2 feet thick, 20 pounds for a bed 4 feet thick, etc.

(3) All material encountered in such a cut should be included in the sample, except partings or binders of more than 0.25 inch



in thickness, and except all lenses or concretions of sulphur or other impurities greater than 2 inches in maximum diameter and 0.5 inch in thickness.

(4) The sample may be sent to the laboratory as it is cut, or it may at once be quartered down to about the size of a quart. If it is quartered down, it should be pulverized to about  $\frac{3}{8}$  inch, and after thoroughly mixing it should be divided into quarters and opposite quarters rejected. The operation of mixing and quartering should be repeated until the desired size of sample is obtained. The operation of pulverizing and quartering should be done as rapidly as possible, so as to prevent a serious change in the moisture-content, and then the sample should be sealed in either a glass jar or screw-top can, bound with wire-tape, and sent to the laboratory for analysis. S. P. SADTLER.

**Tobacco and Sumac. Microscopically vs. Chemically.** By CHESTER AHLUM. *J. Frank. Inst.* November, 1905.—The method used by Chester Ahlum is that of filtering out insoluble particles and staining them with alcoholic Grenacher's borax carmine stain for about fifteen minutes. They are then removed, washed with 35 per cent. alcohol, and transferred to a weak solution of iodine green. They are removed from this in a few minutes and washed with absolute alcohol and placed in oil of cedar. The sumac particles show single-celled hairs, while in the tobacco they are multicellular. S. P. SADTLER.

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## AGRICULTURAL CHEMISTRY.

**The Corrosion of Fence Wire.** By A. S. CUSHMAN. *Bull. 239, U. S. Dept. Agr.*—This bulletin gives in simple and popular language the results of an investigation undertaken to determine why steel wire made in recent years is of shorter life than that formerly made of puddled iron. A brief general description is given of the composition, nature and manufacture of iron and steel, and the conclusion is drawn both from the author's own work and from the work of other investigators, that the unequal distribution of a comparatively high percentage of manganese in steel, coupled with the electrolysis resulting therefrom, is largely, if not chiefly, responsible for the rapid corrosion. It is not believed that lighter galvanizing is a material factor. Puddled iron containing less manganese and having its surface protected with a film of a compound of iron oxide and silica is much less subject to corrosion. F. P. VERTCH.

**The Effect of Water on Rock Powders.** By A. S. CUSHMAN. *Bull. 92, Bur. Chem. U. S. Dept. Agr.*—During the work of the Division of Tests, it has been found that the wet grinding of rock powders gives increased plasticity of the wet mass and

greater binding power in the compressed powders, the increase of binding power in some cases being enormous. In studying this phenomenon it was found that rock powders behave in the same way that many minerals do, that is, they are decomposed to a limited extent by water, the alkaline bases passing into solution, and to a much greater extent under the influence of wet grinding. It was not found possible to titrate the free alkali thus produced, as it was removed almost completely both by filtration and sedimentation. Microscopic examination of the ground powders showed that the surfaces of the grains were covered with a colloidal layer entirely different from the fresh surfaces, and it is to the colloidal nature of their surfaces that both the binding power and the absorptive power of the powders is ascribed, for it was found that these powders (behaving in the same way to salt solutions, that ground minerals and soils do) remove bases from solution and leave the entire quantity of the acid with which the bases were combined in solution, while the alkaline bases of the powders pass to a certain extent, greater than in pure water, into solution. The absorptive power, for the alkaline bases, of the colloidal surfaces of the particles causes a concentration of acid ions and thus accounts for the fading of the color first produced by phenolphthalein added to the wet ground powders. While wet grinding of powders causes greater amounts of the alkaline bases to dissolve, solution is soon inhibited by increasing concentration, and even where the bases are carried away by the electric current measurable solution soon ceases, only to be restored by further grinding, thus showing that it is the layer of colloidal material on the surface of the grains which slows down and finally stops the passage of the bases into solution. The possibility of rendering available for plant growth the potash of minerals in the crystalline rocks by wet grinding and treatment by electrolysis is suggested.

F. P. VERTCH.

**Paints and Paint Products.** BY E. F. LADD AND C. D. HOLLEY. *N. Dak. Expt. Sta. Bull.* 67, 30 pp.—The bulletin deals entirely with white paints, and the authors discuss the various pigments used in this class of paints and the characteristic properties of these pigments. Analyses are reported of six white leads, and of 25 prepared paints, these having been made to determine whether the materials conform to the requirements of the paint law which recently went into operation in that state. Of the six white leads, but one was pure basic lead carbonate; the remaining five contained from 3.6 to 17.4 per cent. of zinc oxide, and from 27.8 to 76.3 per cent. of barium sulphate. Of the prepared paints none was pure white lead paint, one was a pure zinc white, six were mixtures of white lead and zinc white, and the remainder showed a wide variation in composition, the following ingredients besides white lead and zinc white being

reported, lead sulphate, sublimed lead, barium sulphate, calcium carbonate, calcium sulphate, silica, clay, lithopone and magnesium carbonate. The authors made but little study of the vehicle of the paints. Rosin was found in two samples and an excessive amount of water was reported in a number of samples.

L. S. MUNSON.

**Moisture in Wood Pulp.** BY R. W. SINDALL. *The Paper Mill*, 28, 8 (1905).—The determination of moisture in bales of wood pulp is a very difficult operation, as the moisture varies greatly in different bales and in different parts of the same bale. To secure data on this variation, sheets were selected from 23 bales as follows: No. 1 about one inch from top sheet, No. 2 midway between top and middle of bale, No. 3 middle of bale, No. 4 midway between middle sheet and bottom sheet, No. 5 one inch from bottom sheet. Analysis of the sheets showed no regular variation in moisture. In some bales the outside sheets contained the most moisture; in others the middle sheets were the wettest. The average per cent. of dry pulp in all the bales taking sheets 1, 2, 3, 4 and 5 was 53.6 per cent.; taking sheets 1, 2, 3, and 4, 53.6 per cent.; and taking sheets 2, 3, 4 and 5 it was 53.0 per cent.

F. P. VEITCH.

**Some Notes Concerning Halphen's Test for Cottonseed Oil** BY ELTON FULMER. *Bull. 67, Wash. Expt. Sta.* Part 1, 10 pp.—The investigation was taken up to determine (1) the effect of heat upon cottonseed oil in its relation to the Halphen test and the effect of high temperature upon the palatability of the oil, and (2) whether the active substance in cottonseed oil to which the characteristic reaction is due is transmitted apparently unchanged into the fat of animals fed upon cottonseed meal. Results showed that cottonseed oil is rendered inactive towards Halphen's test by heating to 260–270° C., and that the intensity of the reaction is very greatly diminished by heating the oil to 220–240° C., that it is possible to heat cottonseed oil to 280° C. without injuring it and reasonably certain that a temperature of 220° to 240° C. will not render it unfit for use as an article of food, either alone or as part of a mixture, and that lard from animals fed on cottonseed meal may respond to Halphen's test with an intensity of coloration equivalent to several per cent. of unheated cottonseed oil.

L. S. MUNSON.

**Reaction of Lard from Cottonseed-Meal-Fed Hogs, with Halphen's Reagent.** BY ELTON FULMER. *Bull. 67 (Part II), Wash. Expt. Sta.* 17 pp.—The author gives results of an extended feeding experiment in which hogs were fed upon varying amounts of cottonseed meal for different lengths of time, then slaughtered and the fat from different parts of the body submitted to Halphen's test. In all cases the lard from hogs thus fed responded



to the reaction, and the indicated cottonseed oil content ran as high as 15 per cent., the tendency apparently being for the hog to store the largest amount of color-producing substance in the kidney fat. This substance is also shown to exist in marked amounts for many months after the animal has ceased to receive the cottonseed meal ration (see also this Journal, 26, 837 (1904)).

L. S. MUNSON.

**The Beet Sugar Industry in Montana.** By V. K. CHESNUT. *Eleventh Annual Report, Montana Expt. Sta.* p. 233.—The report gives the results obtained with several varieties of beets, part of which were from American grown seed. L. S. MUNSON.

**Food Inspection.** By H. E. BARNARD. *Bulletin Indiana State Board of Health*, November, 1905.—This is the first report regarding food inspection in Indiana. The composition of 1,237 samples of miscellaneous products is given. Of this number 558 were found to conform to the law and 679 to be adulterated or below the legal standard. Of 174 samples of drugs analyzed, 98 were pure and up to the pharmacopoeia standard, and 76 adulterated. Attention is called to the fact that this does not represent the type of food sold in the state, as "in collecting samples for analysis care was taken to purchase articles of a suspicious character, and therefore the extent of adulteration of all classes of food and drug products is represented by a much smaller percentage."

The following tabular statement of the results of the examination is given:

Articles examined.	Of good quality.	Adulterated.	Number examined.	Percentage of adulteration.
<b>Food:</b>				
Butter.....	4	4	8	50.0
Cream.....	28	18	46	39.1
Milk.....	225	57	282	20.2
Lard.....	5	7	12	58.3
Olive oil.....	65	40	105	38.1
Oysters.....	21	5	26	20.0
Sausage.....	36	67	103	65.0
Miscellaneous meat products...	10	7	17	41.0
Codfish.....	...	4	4	100.0
Cream of tartar.....	107	1	108	1.0
Lemon extract.....	15	214	229	93.4
Vanilla extracts.....	11	121	132	91.5
Vinegar.....	12	133	145	91.7
Miscellaneous food products....	19	1	20	5.0
<b>Total .....</b>	<b>558</b>	<b>679</b>	<b>1237</b>	<b>54.97</b>
<b>Drugs:</b>				
Alcohol.....	63	32	95	37.6
Lime-water.....	33	25	58	43.1
Tincture of iodine.....	2	19	21	90.5
<b>Total .....</b>	<b>98</b>	<b>76</b>	<b>174</b>	<b>43.6</b>

W. D. BIGELOW.

**Chemical Analysis of a Few Varieties of Roasted Coffee.**

BY HERMANN C. LYTGOE. *Tech. Quart.* 18, 236 (1905).—The article gives the methods recommended by the author to the Association of Official Agricultural Chemists, and adopted provisionally by the Association. The analysis is also given of three samples each of coffee of the following varieties: Santos, Porto Rico, Rio, Mocha and Java. For comparison, the composition is given of four types of coffee substitutes. W. D. BIGELOW.

**Cereal Foods.** BY L. H. MERRILL. *Bull.* 118, *Maine Agr.*

*Expt. Sta.*—The bulletin contains a general discussion of the composition and digestibility of cereal breakfast foods. Recent work done at the Maine Experiment Station and in other laboratories is reviewed, and a comparison is made between breakfast foods of different types and between all breakfast foods and other cereal preparations. Attention is called to the fact that in the manufacture of articles of this nature the same care is not exercised to secure a product of constant composition as in the case of flour. Wide variations have been observed in the composition of two or more samples of the same brand. "In the digestion experiments upon human subjects the rolled wheat seemed to be somewhat more digestible than the rolled oats, and so far as relates to protein, the most valuable constituent, both rolled oats and rolled wheat are superior to corn. The attempt to increase the digestibility of starch seems to have had a contrary effect upon the protein." Attention is called to the high prices demanded for breakfast foods in some cases as compared with an equal weight of cereal products of similar food value, but it is stated that in this connection the increased cost of manufacturing some of the types of breakfast foods must be considered.

W. D. BIGELOW.

**The Action of Formaldehyde in the Preservation of Milk.**

BY FREDERICK D. CHESTER AND THOMAS R. BROWN. *Bull.* 71, *Del. Agr. Expt. Sta.*—Amounts of formaldehyde varying from 1 part in 800 to 1 part in 40,000 were added to milk, and the formation of various organisms in the milk at different temperatures was noted. It was concluded that in the presence of formaldehyde in amount not greater than 1 part in 5,000 the bacteria decreased during the first twenty-four hours, and after that time multiplied at first slowly, and then rapidly. As the amount of formaldehyde decreased the initial retardation in the increase of bacteria was diminished. It is stated that when milk containing formaldehyde is kept at 25° C., there is a tendency on the part of the formaldehyde to restrain the development of the miscellaneous bacteria originally present in the raw milk, without a corresponding retardation of growth of the common lactic acid ferment. In the presence of formaldehyde to the extent of 1

part in 40,000, milk is preserved for a longer time relatively to the same milk without formaldehyde at from 60° to 70° F. than at a lower temperature. The authors state that the presence of formaldehyde, combined with normal room temperatures, is favorable to a harmless lactic acid fermentation, and unfavorable to a mixed fermentation which is liable to render the milk unwholesome. The authors have conducted no experiments regarding the physiological effect of boric acid, or its influence on the composition of milk. They conclude, however, that the addition of formaldehyde in amount not to exceed 1 part in 40,000, and "the holding of the milk at temperatures between 60° and 70° will improve its sanitary quality by preventing rapid and objectionable fermentations, and there is no reason to believe that in this proportion any marked injury could result to the person consuming it."

W. D. BIGELOW.

**The Digestibility and Nutritive Value of Cottage Cheese, Rice, Peas and Bacon.** BY HARRY SNYDER. *Bull. 92, Minn. Agr. Expt. Sta.*—The digestibility of the foods mentioned was determined, using men as subjects, and the digestibility and nutritive ratio were compared with those of other foods. The results show cottage cheese to be a digestible, nutritious food, and of value approximately equal to meat at 11 cents per pound. Rice is shown to be easily digested when well cooked, but no more completely digested than other cereal foods. The proteids were not as completely digested as those of wheat bread. The proteids of peas were not found to be as completely digestible as the proteids of rice and other cereals. By combining milk with the other foods studied it was found to exert a favorable influence upon their digestibility. An especially favorable comment is made on the large amount of digestible nutrients and available energy supplied by lean bacon. Over 96 per cent. of the bacon fat was digested and absorbed by the body.

W. D. BIGELOW.

**Ration Experiments with Lambs.** BY G. E. MORTON. *Wyo. Agr. Expt. Sta. Bull. 68.*—The experiments carried on were to determine (1) the relative value of native hay and corn as compared with alfalfa and corn; (2) barley and alfalfa as compared with corn and alfalfa; (3) the effect of the substitution of flaxseed for the ordinary grain ration and cause of the excessive flow of urine. For this purpose 66 lambs were used, divided into 3 lots of 20 each, and 2 lots of 3 each. The nutritive ratios of the feed fed the 5 lots were 1:4.8, 1:4.8, 1:10.5, 1:5.1, and 1:4.2. The gain was least in No. 3 whose nutritive ratio was too wide, this lot being fed native hay and corn. The barley-fed lambs and the corn alfalfa lambs made the best gains. The results of feeding flaxseed showed that no urinary troubles appeared. The bulletin is richly illustrated.

J. A. LECLERC.



**Cattle Feeding Experiment.** BY H. R. SMITH. *Neb. Agr. Expt. Sta. Bull. 90.*—The results of the experiments showed alfalfa to be superior to prairie hay, when the grain consisted of corn alone. Alfalfa was also a cheaper source of protein than oil meal. The most economical ration consisted of bright, well-cured corn-stover with an equal weight of alfalfa, the grain used being corn. The ration of corn and prairie hay with a nutritive ratio of 1:10.2 was too wide. The ration consisting of corn-stover and alfalfa, with a nutritive ratio of 1:8.4 gave, however, better results than the corn and alfalfa ration whose nutritive ratio was 1:7.4, thus indicating the correctness of the "American idea" that the German standard calls for more protein than is necessary.

J. A. LECLERC.

**Domestic Butter.** BY A. MCGILL. *Inland Rev. Dept., Ottawa.*—This is a report of analyses of 180 samples of domestic butter, *i. e.*, butter intended for home consumption. Farm-made butters are quite free from borax. On the other hand, the butter from 3 out of 11 creameries supplying Ottawa contained borax. One sample contained more than 16 per cent. of water, 8 samples exceeded 14 per cent., and 114 samples contained less than 10 per cent. The average per cent. of salt was about 3.5. One hundred and thirteen samples contained more than 85 per cent. fat, only 7 samples being below the accepted minimum standard of 80 per cent. fat. This bulletin contains tables giving the date of collecting sample, name and address of vender, cost per pound, name and address of manufacturer, besides the chemical and physical results found on analysis.

J. A. LECLERC.

**The Influence of the Size of the Grain and the Germ of Corn upon the Plant.** BY E. P. WALLS. *Md. Agr. Expt. Sta. Bull. 106.*—It is important to know whether the lighter kernels or those having small germs produce weak plants, in which case such light kernels should be eliminated from seed corn. Many experiments were undertaken to determine whether it was necessary to discriminate between the light weight kernels and the heavy ones. The results follow: (1) "The heaviest grains do not necessarily have the best germinating qualities; (2) the germinating property of kernels having different sizes of germs may be equal; (3) plants from kernels having large germs are more vigorous, have more plant energy and are stronger and hardier in every way." From these results it may be concluded that "high breeding is of more importance than weight or size of grain, and to insure a good stand and a large yield, none but large germed kernels should be used."

J. A. LECLERC.

**Experiments with Corn.** BY T. L. LYON. *Neb. Agr. Expt. Sta. Bull. 91.*—This bulletin gives some results obtained in experiments during the past three years, and discusses such subjects

as "Relation of Size of Ear to Yield; Increasing Yields of Corn by Selection of Plants; Selecting Corn for High Oil Content;" etc. The results of farmers' coöperative tests during three years indicate which are the best yellow and white varieties adapted to Nebraska. Experiments on the relation of the size of the ear to the yield showed that the heaviest yielding varieties are of the medium-eared kind instead of being of the large size. The bulletin has a chapter on "Tillers or Suckers" and discusses their economic value. The method of seed selection practiced has been that of the "individual ear," wherein all the kernels from one ear served as seed for one row. Great variations may be thus obtained from different ears, the yield in this case varying from 35 to 81 bushels per acre. Experiments of increasing the oil content of corn indicated that "seasonal changes affected the oil content independently of natural variation and heredity."

J. A. LECLERC.

**Feeding Stuff.** *Md. Agr. Coll. Quarterly*, November, 1905, No. 30.

J. A. LECLERC.

**Proceedings of the Second Annual Convention of Leather Trades Chemists.** *Shoe and Leather Reporter*, 81, Nos. 21 to 26, 1905. Report of the referee by H. C. Reed.—The work of the referee as finally outlined and conducted was based chiefly on the reports of the subcommittees appointed by him on the following subjects: Evaporation and Drying of Tanning Residues, Soluble Solids Filtration, Chroming of Hide Powder, Analysis of Liquors, Acid Determination, Nitrogen Determination, Extraction, Parker-Payne Method of Tannin Analysis, and Revision of Official Method of Analysis. The work upon evaporating and drying residues was too meagre to base conclusions on, but both the referee and the Association favored the use of a combined evaporator and drier because of the time saved and of the promise of greater uniformity of results with the apparatus. In the study of the effect of temperature on the filtration of soluble solids using quebracho and hemlock extracts, it was clear that it is necessary to have the temperature controlled within narrow limits, that is, within 5°, to prevent large differences in soluble solids. Cooling the solution to a definite low temperature (20°) and filtering immediately at room temperature, is of no advantage with slow-filtering solutions, as in the return to room temperature, the insolubles at low temperature pass again into solution to a greater or less extent, in some instances giving as high solubles as when all operations were conducted at room temperature. No advantage appeared to be gained by reducing the amount of kaolin now used, and S. & S. No. 590 filter-paper appeared to be more uniform than Swedish No. F. No member of the Association was able to obtain results of value with the Berkefeld filter-candle for filtering soluble solids. With quebracho the solution

passed rapidly and cloudy, while hemlock solutions filtered exceedingly slowly and in no case was the agreement with the filter method satisfactory. In chroming hide powder, the addition of all the chrome alum at once was found to be as satisfactory as adding it in two portions, but the time of chroming cannot be reduced to advantage. The percentage of water left in the washed hide after squeezing influences the absorptive power of the hide. The lower the water the slower the absorption. A dry-chromed hide gave poor results. The subject of the analysis of spent liquors received a great deal of attention and the question whether it is better to require from 35 to 45 grams of tannin per 100 cc., ignoring the influence of the large quantity of non-tannin present on the tannin determination in such solutions, or to dilute the solution to contain a given quantity of total solids and reduce proportionally the hide used, was very carefully considered, the figures indicating that the latter procedure is the better. Under the subject of "Extraction," the Soxhlet, Proctor, and Kerr extractors, removing the first two siphonings from the influence of continuous boiling, received particular attention, and while no definite conclusion could be drawn from the results, the evidence was in the main in favor of the Kerr and the Soxhlet where the siphonings were removed after but little boiling. The highest results on tannin and soluble solids were obtained with the extractors devised by Mr. Reed and by Mr. Veitch, both of which allow the frequent removal of the extracted material, and it would appear that this is an essential factor in complete and satisfactory extraction. The importance of grinding the samples very fine was clearly shown in the work and discussion. No conclusions could be drawn from the work on color determinations, nor from that on the Parker-Payne method.

F. P. VEITCH.

**An Extractor for Tanning Materials.** BY H. C. REED. *Hide and Leather*, 30, 31 (1905).—A description is given of an elaborate piece of apparatus with which extractions may be made by percolation alone at any desired temperature and to any desired volume, collected outside or inside the extractor, or by condensation as in the ordinary Soxhlet. Figures are also given to show that in the inventor's hands, higher results on tannin were obtained with the extractor than with the Soxhlet, a fact that is partly explained by the apparent destruction of tannin by continuous boiling in the Soxhlet and partly by the greater total extractive obtained with the new extractor. The extractor was tested on many different tanning materials.

F. P. VEITCH.

**The Pecan, Black Walnut and Butternut.** BY L. E. LEVI AND E. G. WILMER. *Hide and Leather*, December 23, 1905.—



The authors have analyzed the shells of these nuts with the following results:

	Soluble solids. Per cent.	Non-tannin. Per cent.	Tannin. Per cent.
Pecan shell.....	14.01	2.38	11.63
“ whole nut.....	9.04	3.13	5.91
Black walnut, burr.....	31.20	16.50	14.70
“ “ shell.....	5.27	0.30	4.97
Butternut, burr.....	41.53	29.67	11.86
“ shell.....	2.29	1.58	0.71

The reactions with a number of reagents are also given. The oil extracted by petroleum ether from the meat, the meat and shell and from the whole nut, was determined and the constants of the oils were also determined.

	Pecan oil.	Black walnut oil.	Butternut oil.
Oil in whole nut.....	21.72 per cent.	5.18 per cent.	7.88 per cent.
Oil in meat.....	“	40.05	54.01
Sp. gr. at 21° C.....	0.9156	0.9225	0.9263
Turbidity point.....	—2° C.	—3° C.	—0° C.
Solidifying point.....	—7° C.	—13° C.	—10° C.
Hehner value.....	95.65	93.30	91.26
Saponification value....	190.4	190.0	189.8
Iodine value.....	104.1	146.8	161.7
Acid value.....	0.59	0.22	0.21

The meat of the nuts has the characteristic taste after extraction. All the oils are tasteless. F. P. VEITCH.

### Soil Inoculation; Tubercle Forming Bacteria of Legumes.

BY L. L. LEWIS AND J. F. NICHOLSON. *Bull. 68, Okla. Agr. Expt. Sta.*—This bulletin gives the results and conclusions of a laboratory, pot and field study of the bacteria inoculating alfalfa, soy bean and cow pea. In a study of the effect of the composition of the media on alfalfa germs, it was found that the presence or absence of nitrogen is not the controlling factor in the activity of the germ, a bouillon containing from 2 to 5 per cent. of cane sugar or glucose giving the best results. Bacteria grown in such media have maintained their virulence for 35 transfers and inoculations. Cultures of cow peas and soy beans from the United States Department of Agriculture gave negative results, as did also an alfalfa culture from the Nitro Culture Co. Cultures kept in the dark maintain their potency much longer than those kept in bright or diffused light. Experiments showed considerable fixation of nitrogen in several media, most in agar and sugar, and bouillon and sugar media. Alfalfa and sweet clover bacteria do best in alkaline media. It was found that like higher plants, bacteria thrive best in fertile soils, and the fact that the activity of bacteria is only one of the factors of plant production is emphasized. The opinion is expressed that many nitrogen-fixing bacteria maintain their activity for many years even though

the crop upon which they thrive is not grown. Inoculations made from freshly bruised nodules have proved most effective.

F. P. VERTCH.

**Suggestions Concerning Legume Inoculation.** By L. T. CLARK. *Bull. 231, Mich. Agr. Expt. Sta.*—A brief non-technical, popular bulletin on the methods of inoculation, with a warning against too great expectations of large practical gains from inoculation, without first carefully considering the necessity of such procedure. The author's methods of securing pure cultures are given.

F. P. VERTCH.

**The Quality of Commercial Cultures for Legumes.** By H. A. HARDING AND M. J. PRUCHA. *Bull. 270, N. Y. Agr. Expt. Sta.*—Bacteriological examination of a number of treated and dried cotton cultures, such as are used in distributing bacteria for inoculating legumes, showed that the packages were worthless for practical purposes. In but few cases were *Ps. radicola* found to be present. The conclusion is drawn that the failure of the culture is inherent in the method of its preparation.

F. P. VERTCH.

**Soil Treatment in Greenhouse Culture.** By H. J. WHEELER AND G. E. ADAMS. *Bull. 107, R. I. Expt. Sta.*—Experiments were conducted in which radishes, tomatoes, and cucumbers were grown on soils heavily manured with horse manure and manure extract, and on three other plots liberally supplied with plant food but treated differently as to the organic matter content and as to the residues left by the fertilizers used. It was found that after the first crop of radishes, succeeding crops on the plot where horse manure and manure extract were used were small, apparently due to denitrification caused by the manure. The residues left by potassium chloride and ammonium sulphate also appeared to reduce yields except of tomatoes, while the largest yields were obtained where cut hay was incorporated with the soil. This result is attributed to the better relation to moisture and air thus produced. All plots were limed.

F. P. VERTCH.

**Water for Domestic Purposes in North Dakota.** By E. F. LADD. *Bull. 66, N. Dak. Agr. Expt. Sta.*—This bulletin contains a brief general discussion of sanitary analysis, and analyses of a number of surface and artesian wells, spring, creek and river waters.

F. P. VERTCH.

**Fertilizers as Sold.** *Bull. 105, Lab. Inland Revenue Dept., Ottawa, Canada.*—Analyses of 88 samples purchased in the open market in April, May and June, 1905.

F. P. VERTCH.

**Inspection and Analyses of Commercial Fertilizers on Sale in the State.** By W. F. HAND, *et al.* *Bull. 85 and 91, Miss.*

*Agr. Expt. Sta.*—Analyses of fertilizers sampled in 1903-4 and 1904-5 are given, with brief notes on inspection and the text of the fertilizer law as amended in 1904. F. P. VEITCH.

**Analyses and Valuations of Commercial Fertilizers.** By J. P. STREET, *et al.* *Bull.* 187, N. J. *Agr. Expt. Sta.*—Analyses of 232 samples from 96 makers are reported. F. P. VEITCH.

**Fertilizers Registered for Sale in Arkansas during 1905.** By A. M. MACKENFASS. *18th Annual Report. Ark.*

F. P. VEITCH.

**Analyses of Commercial Fertilizers Sold in Maryland.** By H. B. McDONNELL, *et al.* *Md. Agr. College Quart. No.* 29.—Analyses made from March to June 1905 are given together with the text of the fertilizer law. F. P. VEITCH.

**Tabulated Analyses of Commercial Fertilizers Selected from June 1, 1905 to August 1, 1905.** *Bull.* 138, Pa. *Dept. of Agr.*

F. P. VEITCH.

**Analysis of Commercial Fertilizers and Paris Green.** By W. S. STUBBS AND C. W. O'ROURKE. *Bull.* 80, La. *Expt. Sta.*—This bulletin gives the results of analysis of fertilizers and Paris green offered for sale in the state during the season of 1904. Also the text of the law for the inspection of Paris<sup>n</sup> green.

F. P. VEITCH.

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## PATENTS.

JUNE 27, 1905.

793,544. Walter Schwarz, Dortmund, Germany. Centrifugal machine for **purifying furnace gases**. The different drums have a conical shape and the drum shaft may be adjusted for distance between surfaces.

793,558. Oscar Bally, Mannheim, and Hugo Wolff, Ludwigshafen on Rhine. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen. **Anthracene dye**. An anthracene body is condensed with glycerol to make hydroxybenzanthrones. Gives reddish yellow solution in concentrated sulphuric acid, and yellow-brown in dilute caustic soda.

793,560. Max Bazlen and Theodor Wolffahrt, Ludwigshafen-on-Rhine. Assignors to Badische Anilin und Soda Fabrik, same place. **Formaldehydesulphoxylate**. Equimolecular proportions of formaldehyde and of a hydrosulphite are mixed with caustic alkali, as milk of lime. The product is soluble in water but difficultly soluble in absolute methyl alcohol, reducing indigo carmine on heating, and requiring more than three atoms of iodine to each proportion of sulphur present, and giving a white precipitate with sodium carbonate.



793,600. Walter Miller Holtkamp, München-Gladbach, Germany. Making **size**. Potato flour is worked into a uniform paste with water, diluted to ten times its volume, boiled till thick, a water solution of chloride of lime added, and again boiled to a clear solution.

793,610. Karl Reinking and Erich Dehnelt, Ludwigshafen-on-Rhine. Assignors to Badische Anilin und Soda Fabrik, same place. **Discharging compound**. Formaldehydesulphoxylate of sodium, soluble in water, melting at  $64^{\circ}$ , soluble in hot absolute methyl alcohol, and contains no formaldehyde bisulphite compound, reducing indigo carmine on heating and requiring more than three atoms of iodine to each atom of sulphur in neutral solution for titration.

JULY 4, 1905.

793,647-8-9-50-51-52. Reginald A. Fessenden, Washington, D. C. These patents relate to apparatus for **wireless telegraphy** by electromagnetic waves that are practically continuously produced by a high frequency generator, and modified by varying the field of the generator. The receiver is known as a liquid barreter and has an electrolytical conducting fluid path as nitric acid or caustic soda, through a U-tube in which constricted path the fluid may be decomposed with a regulated pressure greater than that of the atmosphere. The first patent is for a capacity consisting of several pieces of cable whose conducting core, insulating sheath and outer conducting covering are stripped successively greater distances from the end, the inner cores being clamped in parallel.

793,743. Traugott Sandmyer, Basel, Switzerland. Assignor to Aniline Color and Extract Works, same place. **Diazo compounds**. Naphthalene-1,2-diazo oxide sulphonic acids are made by diazotizing 1-amino-2-naphthol with sodium nitrite in the presence of a copper salt.

793,771. George M. Dallas, Chicago, Ill. Assignor to Richard H. Thomas, same place. **Artificial fuel**. Pulverized coal 50,000, clay 200, charcoal 25, potash 5, oil cake 5, water 250, and paraffin residuum 500 parts, borax 10, sulphate of zinc 25, and acetic acid 3 parts, all mixed and heated in a closed retort, and then briquetted.

793,795. Howard E. Marsh, Los Angeles, Cal. Assignor one-half to Wm. P. Waggy, same place. **Fuel briquettes**. Fine coal is moistened by a solution of 1 part each of gelatin and bichromate potash in 16 parts water.

794,000. Adalbert W. Fischer, Philadelphia, Pa. Assignor to Schutte and Koerting Co., same place. **Purifying gas**. A liquid as water is heated above its boiling-point at the pressure of the gaseous medium, such as producer gas, and sprayed into

the gas to secure an intimate mixture and precipitation of impurities as dust, etc.

794,049. Paul Seidel and Robert Wimmer, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Indigo white.** Indoxyl is oxidized by a limited quantity of indigo in the presence of a salt of iron.

794,050. Paul Sellet, Ludwigshafen-on-Rhine. Assignor to Badische Anilin und Soda Fabrik, same place. **Hydrosulphite indigo vat.** A hydrosulphite vat containing 1 gram per liter of indigo at 50° C. made alkaline with ammonia, and adapted to fix 4 per cent. of indigo on wool fiber in twenty minutes.

794,052. Otto Sohst, Höchst-on-Main, Germany. Assignor to Meister, Lucius und Brüning, same place. **Orange-red acridine dye.** Leucoacridine yellow is alkylated by hydrochloric acid and alcohol, then heated to a high temperature with formaldehyde and strong sulphuric acid, making a brown-red powder soluble in water orange-yellow, giving with concentrated sulphuric acid a yellow solution with green fluorescence, turning yellow with a little water and red with much, insoluble in ether, benzene and ligroin, and adapted for dyeing leather.

794,144. John F. Dunne, Liverpool, England. **Igniter.** Potassium chlorate 5, potassium bichromate 2, lime  $\frac{1}{4}$ , manganic dioxide and tobacco dust 1 part each by weight.

794,152-3. Charles S. Price, Westmont, Pa. Using **flue dust.** One part clay is added to 8 parts flue dust and water enough to make a stiff mass, the same is briquetted and charged into a blast-furnace.

#### JULY 11, 1905.

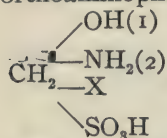
794,198. William Stewart, Mount Florida, Glasgow, Scotland. **Recovering zinc from ores.** The pulverized ore is mixed with the bisulphate of an alkali metal and common salt, and is furnaceed at a red heat; then lixiviated and the zinc salts precipitated.

794,206. Robert R. Walker, East Liverpool, Ohio. Assignor to Charles E. Walker, same place. **Roofing material.** A flexible roofing material which consists of a central section of woven fabric saturated with a material containing elastic baking japan 40, asphaltum 50, and rosin 10 per cent.

794,272. Ralph Baggaley, Pittsburg, Pa. **Producing copper mattes, white-metal, and blister copper.** A bath is made by melting matte-making material in a vessel, producing thereby a low-grade matte, removing slag and adding thereto from time to time ore in smaller quantities than the molten bath, blowing air through the bath and by the heat developed fusing and fluxing the additions to the ore, all in one vessel.

794,314. Bernhard Richards, Basel, Switzerland. Assignor to

Aniline Color and Extract Works, formerly John A. Geigy, same place. **Process of dyeing.** Wool from an acid bath is dyed violet to blue with dyestuffs obtained by the combination of  $\alpha$ -naphthylamine and ethyl- $\alpha$ -naphthylamine with the diazo compounds of orthoaminophenol derivatives having the general formula



, and then treating the dyed goods with copper salts.

794,373. Eduard Meusel, Liegnitz, Germany. **Modifying oils.** Fatty oils are modified by oxidizing the glycerol and oleic acids by subjecting them to the action of denitrifying bacteria in the presence of nitrates in aqueous solution, the nitrates being deoxidized.

794,413. Lucius R. Keogh, Hamilton, Canada. **Aluminum compounds.** Aluminous materials are subjected to the action of sulphur-gases to form sulphate of alumina, mixing this sulphate of alumina with sodium chloride and carbonaceous material, and heating the mixture in the presence of steam to evolve gaseous hydrochloric acid with the steam and to form a second mixture of alumina, sulphate of soda and carbonaceous material, condensing the gaseous hydrochloric acid, heating this second mixture of alumina to form a third mixture which is heated as the former mixtures with steam and air to form aluminate of soda and to evolve sulphurous gases, recovering the aluminate of soda, precipitating the alumina in the hydrated form and recovering the soda.

794,481. David M. Balch, Coronada, Cal. Assignor of one-half to Anson P. Stephens, San Diego, Cal. **Fuel from seaweed.** Seaweed is first dried and then coated with an alkaline substance, like air-slaked lime, heat is applied and the charred residuum lixiviated; it is then dried and commingled with a combustible agglutinant as crude petroleum and molded into suitable briquettes.

794,512. Rudolph Knietsch, Ludwigshafen-on-the-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Catalytic substance** A catalytic substance which consists of burnt pyrites carrying a deposit of platinum.

794,552. George M. Rice, Worcester, Mass. **Gathering gold diffused in mercury.** A comminuted metal as silver or copper capable of forming an amalgam, is added to the mixture that will act as a scavenger or gatherer of the gold when straining or squeezing out the mercury.

794,568. Alfred Thaus, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Azo dye.** Diazotized orthotoluidine is combined with the metaamino-



benzenylthio-2-5-aminonaphthol-7-sulphonic acid, which dyestuff in the shape of its sodium salt is a reddish brown powder soluble in water and in concentrated acid with a red color; dyeing unmordanted cotton red shades, which can be further diazotized and developed on the fiber by means of  $\beta$ -naphthol, red shades of a yellower tint being thus obtained, which are fast to washing.

794,581. David Bachrach, Baltimore, Md. **Compounds of nitrocellulose.** A non-inflammable or slow-burning compound of nitrocellulose is produced by the addition to the usual constituents thereof the non-aqueous silicates of methyl, ethyl and amyl, and similar silicates known as "silicic esters," and a free acid.

794,583. Harold Boyd, London, England. **Explosive composition.** An explosive composition of which the ingredients mainly are equal parts of sodium nitrate, resin and naphthalene, ground together and sprinkled with petroleum and sulphur and oil shale in the proportions of one-half and one-third the weight of nitrate added, again ground and made into cartridges.

794,623. Julius Herbabny, Vienna, Austria-Hungary. **Blood products.** Blood is coagulated by heat, acids or alkalies, the coagulum separated, color and a filling are added, the mixture treated with formaldehyde, molded and dried, to make handles, battery cells, etc.

794,644. Frederic J. Smith, Elizabeth, N. J. Assignor to Am. Agricultural Chemical Co., New York, N. Y. **Fungicide.** Phosphoric acid and copper sulphate are mixed, lime and calcium arsenate added, and the whole dried and ground.

794,697. Harold M. Beck, Chicago, Ill., and Edward W. Smith, Philadelphia, Pa. Assignors to the Electric Storage Battery Co., same place. **Hydrometer.** A large sealed outer tube contains a small inner tube whose upper end is open, and whose lower end projects through the end of the larger tube and has an opening for the ingress and egress of the fluid to be tested, the large tube containing also a temperature compensating substance.

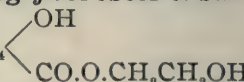
JULY 18, 1905.

794,771. Aleck Bauer and Bertram K. Hollister, Chicago, Ill. Assignors to Bauer and Black, same place. **Formaldehyde candle.** A shell is made of charcoal having cross walls forming an integral part of the shell and dividing it into a plurality of compartments open at top and bottom, in which there are tablets of paraformaldehyde; a kindler surrounds the shell at its upper edge.

794,789. Joseph L. Danziger, New York, N. Y. Assignor to Castner Electrolytic Alkali Co. **Carbon tetrachloride.** Carbon bisulphide is treated with sulphur chloride in the presence of

amalgamated aluminum, twice the theoretical quantity of sulphur chloride being employed.

794,970. Same. **Purifying carbon tetrachloride.** A process for purifying carbon tetrachloride by digesting it with an alkaline sulphide containing an excess of free alkali.

794,982. Fritz Hofmann, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., N. Y. **Monoglycol ester of salicylic acid.** A body having the formula  $C_6H_4$  

and being a limpid odorless oil boiling at  $173^{\circ}C$ . under a pressure of about 14 mm., the alcoholic solution being colored violet by ferric chloride, being split up into salicylic acid and ethylene glycol when reacted upon by caustic alkalies, and possessing valuable therapeutic properties.

795,026. Allen L. Comstock, Boston, Mass. Assignor to Boston Rubber Shoe Co., Boston, Mass. **Process of vulcanization.** Rubber or allied gums to be vulcanized are heated under pressure in an atmosphere composed of a mixture of non-oxidizing gas and air in about equal proportions.

795,058. Alexander Otto, Höchst-on-Main, Germany. Assignor to Farbwerke, vorm. Meister, Lucius und Brüning, same place. **Bisulphite compound of a tetrazo dye.** The dye is produced from one molecular proportion of *o*-tetrazo-phenol-*p*-sulphonic acid and two molecular proportions of  $\beta$ -naphthol by adding to the dyestuff dissolved in a solution of the sodium bisulphite a quantity of mineral acid just sufficient to produce an acid reaction, and then evaporating to dryness. The product is a stable bisulphite compound being a red-brownish powder readily soluble in water, its brown-red solution assuming in the cold a violet color on addition of sodium carbonate and on being heated separating the dyestuff.

795,116. Randolph H. Goddin, Newport News, Va. **Paint composition.** A paint composition composed of gas-tar 4, red lead 4, Paris-green 2, linseed-oil 2, sugar of lead 1, sulphur  $\frac{1}{10}$ , black asphaltum 1 part and a drier to suit requirements.

795,193. Harry H. Campbell, Steelton, Pa. **Chromiferous iron.** It is charged into a basic Bessemer converter, producing basic slag, the chromium being oxidized by blowing air through the body of the metal, thereby causing the chromium to become a part of the slag, and then separating the metal and the slag.

795,215. Frederick Foster, New York, N. Y. **Composition for cleaning printing surfaces.** A solution consisting of 4 parts of powdered alum, 4 parts of carbonate of soda, 1 part carbonate of potassium, 10 drops of a 10 per cent. solution

of gallic acid; 4 parts of sodium hydroxide and 32 parts of water.

JULY 25, 1905.

795,275. Carl von Forell, Hamburg, Germany. Assignor to Henry Edmunds, London, England. **Portland cement.** Water-granulated furnace slag and slag meal are briquetted and roasted in an oxidizing flame in a rotary kiln, a little water added to the hot slag, which is projected against chilled surfaces to disintegrate it, and afterwards it is ground.

795,294. Michael F. Maginnis, Philadelphia, Pa. **Fuel briquet.** Powdered bituminous coal 2,000, plaster of Paris 150, coal ashes 20, salt 75, alum 15, molasses 40, linseed cake or meal 20 and water 130 parts by weight.

795,399. Robert R. Layburn and Patrick J. Reilly, Brooklyn, N. Y. **Waterproof building block.** Sand 46, magnesia 25, magnesium chloride 10, glycerol and dextrin 2 each, and water 15 parts by weight.

795,495. Alfred Einhorn, Munich, Germany. Assignor to Meister, Lucius und Brüning, Höchst-on-Main, Germany. **Alkyl-barbituric acids.** Diphenyl carbonate is heated with diethyl malonamide to 190° C. to 250° C. for some time.

795,517. Edward D. Kendall, Brooklyn, N. Y. Assignor to Edward N. Dickerson, Stovil, N. C., and Emma R. Olcott, New York, N. Y. **Tungsten steel.** Tungsten ore, metallic zinc and iron are mixed and smelted in an electric furnace.

795,525. Carl Linde, Munich, Germany. Assignor one-third to Charles F. Brush, Cleveland, Ohio. **Oxygen and nitrogen gases.** Self-intensifying coils are combined with rectifying columns for the treatment of liquid air and its separation into its constituent gases by evaporation.

795,526. Rudolf Linkmeyer, Herford, Germany. **Artificial silk.** Cellulose is dissolved, first in a weak solution of ammoniacal copper oxide then in a stronger solution. Caustic soda may be added to the first solution.

795,562. Silvio T. Tatti, Buenos Ayres, Argentina. **Disinfectant.** Layers of textile material have interposed between them layers of a mixture of rubber with magnesium oxide and charcoal 400 parts each, calcium hydroxide and zinc oxide 100 parts each.

795,587. Otto Dieffenbach and Eduard C. Harburg, Griesheim-on-Main, Germany. Assignors to Chemische Fabrik Griesheim Electron, Frankfort-on-Main, Germany. **Igniter.** Phosphorus oxide 10, potassium chlorate 40, gypsum 6, chalk 4, powdered glass 25 and glue 16 parts.

795,678-9. Max Bamberger, Frederick Bock and Friedrich



Wanz, Vienna, Austria-Hungary. Apparatus and process of **generating exhaled air**. The exhaled air is made to pass through alkali peroxide and return to the lungs.

795,734. James E. Seeley, Los Angeles, Cal. **Cementing bodies**. The surfaces to be united are both coated with a gelatine cement and then with formaldehyde before uniting.

795,751. Oscar Bally, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Anthracene compound**. Anthranol and benzaldehyde are condensed in the presence of sulphuric acid to yellow needles that melt at  $114^{\circ}\text{C}$ ., insoluble in dilute acids or alkalies, but soluble in strong sulphuric acid to a fuchsin-red solution.

795,755. Max Bazlen. Assignor to Badische Anilin und Soda Fabrik, all of Ludwigshafen-on-Rhine, Germany. **Stable hydrosulphite**. Hot ethyl alcohol is applied to hydrosulphites containing water till it is all removed.

795,757. Henry S. Blackmore, Mt. Vernon, N. Y. **Formaldehyde product**. Powdered talc (10,000 parts) is mixed with paraformaldehyde (1 part) and dried at  $250^{\circ}\text{F}$ . in a vacuum. 3,000 parts alumina may be added, also orris root, etc.

795,790. Carleton Ellis, New York, N. Y. Assignor to Eldred Process Co., same place. Making **gas**. Air and products of combustion are passed through red hot fuel in such proportions as to create a partial pressure of carbon dioxide within the furnace, whereby the fixed carbon of the fuel is all converted into carbon monoxide.

795,797. Per B. Harje, Lilla Harrie, Sweden. **Lime saccharate**. Lime is introduced at different points into a flowing saccharine solution, the precipitated lime being returned in the opposite direction.

WM. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Notes on the Bath Furnace Aerolite.** By HENRY A. WARD. *Proc. Rochester Acad. Sci.* 4, 193-202; plate.—The external characteristics of this (this Journal, 25, R 272) and other meteorites, coupled with the almost total lack of evidence that such of them as reach the solid earth are hot or even warm in their interior, leads the author to a discussion of the probable effects of aerial friction and of the cause of the detonations frequently heard during their flight. Although manifestly rendered intensely hot superficially by friction, the melted layers are brushed off as fast as formed, so that there is no chance for the interior, possessed of the cold of outer space, to become much heated.

W. F. HILLEBRAND.

**Coal Analysis.** By AVERY LEAVITT. *Univ. of Colorado Eng. J. No. 1, 1904-1905*, pp. 65-67.—This paper gives the results of proximate analyses of 28 varieties of Colorado coals, made with a view to determine the comparative values of the coals from different fields. It is preliminary to an extensive investigation, including calorimetric tests, to be made at the University of Colorado.

W. F. HILLEBRAND.

**Genesis of the Ore Deposits at Bingham, [Utah.** By J. M. BOUTWELL. *Bi-Monthly Bull. Am. Inst. Min. Eng.* Nov. 1905, pp. 1153-1192; figures.—This is "essentially a condensation of a chapter in a detailed report on this district, together with so much on geologic features, and on the character and occurrence of the ores as bears on the problems of ore deposition" (see this Journal, 26, R 605).

W. F. HILLEBRAND.

**The Limestone-Granite Contact-Deposits of Washington Camp, Arizona.** By W. O. CROSBY. *Bi-Monthly Bull. Am. Inst.*

*Min. Eng. Nov. 1905*, pp. 1216-1243.—See this Journal, 26, R 612. W. F. HILLEBRAND.

**The Limestones of Ontario.** BY WILLET G. MILLER. *Thirteenth Rep. Bureau Mines Ontario, 1904*, Part II, pp. 142; plates.—In this comprehensive report the occurrences are arranged by counties and districts, accompanied by descriptions and numerous analyses, both old and new, and preceded by a brief account of the uses of limestone and lime. W. F. HILLEBRAND.

**Peat, Its Formation, Uses and Occurrence in New York.** BY ARTHUR L. PARSONS. *New York State Museum, 57th Rep. of the Director and 23d of the State Geologist, 1903*, pp. 15-88.—The information contained in this report is of much more than local value. The economic aspects of the subject receive most attention, and the composition of peat from various states and foreign sources is represented by copious analyses. The bibliography at the end will be welcome to those interested in the subject of peat. W. F. HILLEBRAND.

**Notes on the Gypsum Industry in New York.** BY ARTHUR L. PARSONS. *New York State Museum, 57th Rep. of the Director and 23d of the State Geologist*, pp. 89-157; plates.—Much of the information relating to the history, geology and technology of gypsum in this report has been compiled from earlier publications. The same is true of the analyses. A bibliography of the more important articles treating of gypsum in general and New York gypsum in particular concludes the report. W. F. HILLEBRAND.

**Abrasives of New York State.** BY HARRY C. MAGNUS. *New York State Museum, 57th Rep. of the Director and 23d of the State Geologist*, pp. 158-179.—The substances treated of are: Garnet, emery, diatomaceous earth, millstones, oilstones, and the artificial products alundum and carborundum. There is likewise a partial bibliography. W. F. HILLEBRAND.

**Minerals Not Commercially Important.** BY HERBERT P. WHITLOCK. *New York State Museum, 57th Rep. of the Director and 23d of the State Geologist*, pp. 180-192.—This is little more than a list of occurrences. W. F. HILLEBRAND.

**List of New York Mineral Localities.** BY H. P. WHITLOCK. *New York State Museum Bull. 70*, 108 pp.—The tables include the geological and mineralogical associations of the minerals. There is also an extended bibliography. W. F. HILLEBRAND.

**The Problem of the Metalliferous Veins.** BY J. F. KEMP. *Science*, 43, 14-29.—Presidential address before the New York Academy of Science, December 18, 1905. The following quota-



tion will serve to give an idea of the scope of the address. "By comparison we can grasp in a general way the amount of concentration which must be accomplished by the geological agents in order to collect from a naturally lean distribution in rocks enough of a given metal to produce a deposit of ore; and can then naturally pass to a brief discussion and description of those agents and their operations." The growing recognition of the importance of magmatic as contrasted with meteoric waters as factors in ore deposition is dwelt upon and explained.

W. F. HILLEBRAND.

**Description of the Sundance (Wyoming) Quadrangle.** By N. H. DARTON.—This is the descriptive text accompanying *Folio 127 of the Geologic Atlas of the U. S.*, issued by the Geological Survey. Besides a few analyses from outside sources of coals, of the absorbent clay-like bentonite and of an artesian water from Jerome, there are in the section on igneous rocks analyses by George Steiger of two trachytoid phonolites (pulas-kose and akerosé), phonolite (laurdalose), and nepheline-bearing augite-vogesite (kentallenose).

W. F. HILLEBRAND.

**Mineral Resources of the United States, Calendar Year 1904.** 1264 pp. By DAVID T. DAY.—Many of the reports appearing in this bound volume are very much abbreviated in comparison with the original publications as they appeared in the form of advance extras during 1905, and a few of the latter are altogether omitted. Those containing matter of special interest to the chemist have already been noticed in this review.

W. F. HILLEBRAND.

**Bulletin of the Bradley Geological Field Station of Drury College (Springfield, Mo.).** Vol. 1, Part 2, pp. 45-101; maps, plates.—The chemical material consists of analyses, made for the most part by Harrison Hale, of well, creek, and spring waters from Oklahoma and Indian Territories and Missouri. These are unfortunately reported in terms of salts instead of in the more rational form of acid and basic radicals. E. C. SULLIVAN.

**Corundum and the Peridotites of Western North Carolina.** By JOSEPH HYDE PRATT AND JOSEPH VOLNEY LEWIS. *North Carolina Geol. Survey, Vol. I*, 464 pp.; maps, plates. This is a very full treatise on the geology, petrology, and mineralogy of the belt of corundum-bearing rocks in western North Carolina, the first of a series of somewhat extended reports on special subjects to be published by the North Carolina Geological Survey. "The larger quantity of the corundum is associated with basic magnesian rocks known as peridotites." As to origin, by far the greater part was formed by crystallization of alumina from the original intruded peridotite magma, segregation of corundum

taking place along the comparatively cool line of contact with country rock. A very small quantity resulted from alumina furnished by the corrosion of anorthite by the molten magnesian magma. The alteration products of corundum and its associates are described in detail. A chapter is devoted to chromite and other economic minerals of the corundum-peridotite belt; among the latter are asbestos and the corundum gems ruby, sapphire, etc. Appended is a bibliography of some twenty pages.

E. C. SULLIVAN.

**The Copper Deposits of the Clifton-Morenci District, Arizona.**

BY WALDEMAR LINDGREN. *U. S. Geol. Survey, Professional Paper No. 43*, 375 pp.; maps, plates, figures.—An extended summary of the author's views regarding the genesis of the great copper deposits of this famous district has already been noted at some length in this Review, as also the description, in collaboration with the reviewer, of many of the minerals occurring there (this Journal, 27, R 81). The present report represents an exhaustive study in the author's usual thorough manner of the geology of the region, of the ores, and the mines, in which there is much to interest the mineral chemist and the metallurgist, and the student of ore deposits generally. Besides a few analyses of the minerals above alluded to, there are detailed analyses by survey chemists of fresh and altered porphyries, quartz-monzonite porphyry, clay shale, black Devonian shale and its contact metamorphosis, garnet and garnet rocks, limestones and alteration products, sericite, and many technical analyses of ores, limestones, furnace products, etc.

W. F. HILLEBRAND.

**Structural Relations of the Wisconsin Zinc and Lead Deposits.** BY U. S. GRANT. *Economic Geology*, 1, 233-242; figures.

—In this paper is summarized our knowledge of this region, based on the latest mining developments. "The ores below the level of ground water consist of galena, sphalerite and iron sulphide, the latter commonly in the form of marcasite. Above this level are galena, smithsonite and limonite. The earlier mining in the region was confined mainly to the ores in the oxidized zone, while the mines working to-day are almost entirely below the level of ground water. The ores occur in crevices in the dolomite, or in disseminated particles in certain beds. Where the ores occur in crevices they are usually arranged in the following order from the wall rock towards the center of the veins: (1) marcasite, (2) sphalerite with some galena, (3) galena in large crystals. In the deepest parts of the mines the third layer is commonly lacking." The ores evidently owe their origin to circulating underground waters, which have extracted the heavy metals from the dolomite and concentrated them in certain positions. The reducing action of carbonaceous matter in the

so-called "oil rock" was probably the cause of precipitation, in certain cases at least, and in others perhaps hydrogen sulphide emanating from this carbonaceous matter and ascending to higher levels.

W. F. HILLEBRAND.

**The Terlingua Quicksilver Deposits.** BY H. W. TURNER. *Economic Geology*, 1, 265-281; figures.—This paper may be considered as supplemental to *Bull. No. 4 of the Texas State Mineral Survey* (this Journal, 25, R 20). The known deposits of commercial value are found in a zone 15 miles in length by 2 in width. The geological formations represented in this zone are Tertiary lavas, Upper Cretaceous shales and sandstones, and Lower Cretaceous sediments, chiefly limestone. In the lavas the ore, so far as known, is entirely cinnabar, accompanied by much iron disulphide and some calcite, but without silica. The cinnabar impregnates the whole mass to some extent, but is concentrated along joint planes and seams. A mine water from one of the shafts was highly sulphuretted and contained over 257 grains per gallon of solids, chiefly sulphates in which alkali predominated, followed by lime and magnesia. In the Upper Cretaceous sediments bitumen is a characteristic associate of the cinnabar. The Lower Cretaceous sediments have thus far been the chief productive sources for ore. In them the lodes are of two kinds, friction-breccia lodes and calcite lodes. In the former the crushed limestone and shale are cemented by calcite and gypsum. There was originally much iron sulphide which has been almost wholly oxidized. The minerals observed in lodes of the district are: Calcite, gypsum, aragonite, chalcedonic quartz in a few instances, iron disulphide, hematite and limonite, black oxide of manganese, hydrocarbons, cinnabar, the oxychlorides of mercury, terlinguaite and eglestonite, the oxide of mercury, montroydite (see this Journal, 28, 122, for an as yet unnamed nitrogenous mercury mineral), calomel, native mercury and fluorite. "The occurrence of the best ore bodies in the vicinity of the intrusive rock suggests that it may have furnished the heat, and was thus the primary cause of the formation of the heated solutions and gases which transported the mercury from below up through the fault-fractures and deposited the same therein."

W. F. HILLEBRAND.

**Preliminary Notice of a New Meteorite from Texas.** BY KENNETH S. HOWARD. *Am. J. Sci.* 21, 186.—This aerolite, which fell in 1882, will be known as the Estacado in reference to its locality of fall, the Staked Plains of northwestern Texas. Sp. gr. 3.63. Metallic part 16.41 per cent. Stony part 83.59 per cent., of which 53.61 per cent. is insoluble in hydrochloric acid, and 29.98 per cent. is soluble. The metallic portion is composed as follows: Fe, 89.45; Ni, 9.99; Co, 0.56; P and Cu, traces. Total, 100.00.

W. F. HILLEBRAND.



**The Phase Rule and Conceptions of Igneous Magmas.** By A. L. DAY AND E. S. SHEPHERD. *Economic Geology*, 1, 286-289.—This is a criticism of a paper already reviewed in the pages of this Journal, 28, R 56. W. F. HILLEBRAND.

**The Origin of Clinton Red Fossil-Ore in Lookout Mountain, Alabama.** By WILLIAM M. BOWRON. *Bi-Monthly Bull. Am. Inst. Min. Eng.* 1905, pp. 1245-1262.—Contrary to the view which regards the ore as an original deposit the author considers that it is the result of the precipitative action of limestones on descending waters carrying ferrous sulphate. The evidence is chiefly the existence of forms showing the transition from limestone to ferric oxide. E. C. SULLIVAN.

**On Wollastonite and Pseudo-Wollastonite, Polymorphic Forms of Calcium Metasilicate.** By E. T. ALLEN AND W. P. WHITE, with Optical Study BY FRED. EUGENE WRIGHT. *Am. J. Sci.* 21, 89-108.—The inversion temperature for these enantiotropic forms lies at about 1180°. Wollastonite, stable below that temperature, was prepared by devitrifying in the Bunsen flame the glass obtained by chilling the molten liquid. Above the inversion point wollastonite goes over at once into the pseudo-modification; in the reverse direction the change fails altogether, even after days of heating in contact with the stable form, unless certain other substances are present. Calcium vanadate brings about the reversion by formation of a solution from which wollastonite crystallizes. Excess of lime or silica also facilitates the reversion. The absorption of heat accompanying the transition into the pseudo form was observed; the volume change is, however, so slight that it is uncertain which form is more dense. Pseudo-wollastonite melts at 1512° to a comparatively thin liquid. On cooling, crystallization almost always begins above 1200° or, beginning lower, takes place largely above 1200°, owing to the liberation of heat by crystal-formation. Hence earlier attempts to prepare wollastonite have usually resulted in pseudo-wollastonite, which is not known as a mineral. Addition of such substances as fluorides and borates lowers the temperature of crystallization and thus may cause formation of wollastonite. "The chief results of the optical study were: (1) Identification of artificial wollastonite" and "(2) Determination of the pseudo-hexagonal, probably monoclinic crystal system of the second form of calcium metasilicate." It also developed the interesting fact that after alteration to the pseudo-form "each one of the original wollastonite crystals had changed entirely to one pseudo-wollastonite individual alone, due perhaps to the minute size of the original crystals and to the equality of specific volumes of the two forms." Dr. Geo. F. Becker comments on the geological significance of the data presented. Examination of natural

wollastonite indicates that it is not the result of inversion from pseudo-wollastonite. The fact that wollastonite cannot have formed above  $1180^{\circ}$  defines to that extent the temperature of metamorphism of the limestone in which, as a contact mineral, it characteristically occurs. "If the wollastonite of the nepheline syenite is primitive, at least one family of deep-seated intrusives has been injected at temperatures lower than  $1180^{\circ}$ ."

E. C. SULLIVAN.

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### ANALYTICAL CHEMISTRY.

**The Valuation of Lubricating Oils.** *Chem. Eng.* 3, 10 (1905).

—In the introduction of the article, some interesting facts are given concerning the importance of good lubrication and the money value of economy of power. There is no attempt to give any new information. There are six conditions which should be fulfilled by a good lubricating oil; (1) it must be sufficiently viscous to keep two surfaces apart but must have very little internal friction; (2) the oil must remain liquid at the temperature at which it is used in the machine; (3) it must not give off inflammable or explosive vapors, nor take fire when exposed to moderate heat; (4) it must contain no acid, and must form no acid on exposure, since acids corrode the bearings; (5) it must not dry nor gum on exposure to air; (6) it must stick well to the surfaces to which it is applied. The author discusses the relative merits of animal and vegetable oils, and describes methods for determining vegetable oils in mixtures and for determining free acids. One test suggested consists in treating weighed strips of bright copper or iron with the oil. These may be heated or not, and the time of contact with the oil made long or short. Eventually the strips of copper or iron are cleaned with ether, dried and weighed. The loss in weight represents the amount of corrosion under the conditions employed.

T. G. DELBRIDGE.

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### METALLURGICAL CHEMISTRY.

**American Law Relating to Minerals.** By C. H. SHAMEL. *School of Mines Quarterly*, November, 1905.—Although not strictly metallurgical, yet the article discusses the legal decisions made regarding many metalliferous minerals, the testimony of metallurgical experts and the decisions of the courts. It is interesting and instructive.

J. W. RICHARDS.

**A Furnace for Metallurgical Research.** By W. MCA. JOHN-SON. *Electrochem. Metal. Ind.* September, 1905.—Description of a laboratory furnace costing about \$175, consisting of a large muffle heated by natural gas, the air for combustion being drawn

through fire-clay pipes heated by the products of combustion, and the walls being double, with air spaces between. The muffle chamber was 30 inches by 22.5 inches, and 15 inches high, with its floor covered by silica sand, to absorb any slag spilled on it. Regulation of heat was very satisfactory. J. W. RICHARDS.

**Thermophysics of Chemical Compounds.** By J. W. RICHARDS. *Electrochem. Metal. Ind.* September and October, 1905.—A discussion of the specific heats in solid, liquid and gaseous states, and latent heats of fusion and vaporization of all the chemical compounds met with in metallurgical operations. Among the new data determined or calculated by the author are.

*Carbon dioxide*,  $S_m(o-t)$  per  $m^3 = 0.37 + 0.00022t$ .

*Alumina*,  $S_m(o-t)$  " kg  $= 0.2081 + 0.0000876t$  (to  $1200^\circ$ ).

Latent heat of fusion  $= 50.9$  calories (at  $2200^\circ$ , calc.).

Heat in liquid  $= 890$  " "  $2200^\circ$ , "

S, of liquid  $= 0.593$  (calculated).

*Silica*,  $S_m(o-t)$  per kg.  $= 0.1833 + 0.000077t$  (to  $1200^\circ$ ).

Latent heat of fusion  $= 109$  calories (at  $1900^\circ$ , calc.).

Heat in liquid  $= 761$  " "  $1900^\circ$ , " ).

S, of liquid  $= 0.476$  (calculated).

*Sulphur dioxide*,  $S_m(o-t)$   $im^3 = 0.36 + 0.0003t$  (part calc.).

*Lime*,  $S_m(o-t)$  per kg.  $= 0.1779 + 0.000071t$  (calc.).

*Ferric oxide*,  $S_m(o-t)$  " "  $= 0.1456 + 0.000188t$  (to  $900^\circ$ ).

*Magnetic oxide*, " " "  $= 0.1447 + 0.000188t$  (to  $1000^\circ$ ).

*Zinc oxide*, " " "  $= 0.1212 + 0.0000315t$  (to  $1000^\circ$ ).

*Tin oxide*, " " "  $= 0.1018 + 0.0000062t$  (to  $1000^\circ$ ).

Two problems are also given, the first dealing with the fusion of calcined bauxite in an electric furnace, in which it is calculated from its composition that 817 calories are necessary for fusion of each kilogram, that 951 kilowatt-hours of electric energy would be required, if applied at an efficiency of 100 per cent., and that 2000 kilowatt-hours would be actually required in practice. The second problem deals with the reduction of ferric oxide by carbon monoxide, when one-third the latter is utilized, and calculates that at  $900^\circ$  the reduction of  $Fe_2O_3$  evolves 21,695 calories per molecule reduced, which, if the furnace gases were at  $900^\circ$  to start with, would raise their temperature to  $1046^\circ$ , thus proving that the reduction is exothermic at  $900^\circ$ . The reduction of  $Fe_2O_3$  by solid carbon to the same products is shown to be endothermic to the extent of  $-78,960$  calories at  $0^\circ$ , and of  $-60,850$  at  $900^\circ$ , proving that if the reaction started at  $900^\circ$  the heat absorbed would chill down the charge greatly.

J. W. RICHARDS.

**The Rothberg By-product Coke Oven.** *Iron Age*, Oct. 5, 1905.—Description of a plant of 80 ovens, each 16 inches by 6 feet 6 inches by 36 feet, making 4.7 tons of coke each per day from a



charge of 6.6 tons of coal. The composition of the coal and coke are:

	Coal.	Coke.
Volatile matter.....	34.50	1.50
Fixed carbon.....	54.50	84.50
Ash.....	11.00	14.00
	<hr/>	<hr/>
Sulphur.....	1.00	1.00

Specific gravity of coke 1.83, cell space 41.13 per cent.; amount of "breeze" 1.50 per cent. Yield 71 per cent. of coke; 9.960 cubic feet of gas per ton of dry coal, of which 6,700 cubic feet is used under the ovens, and 3,260 cubic feet, or one-third is surplus. 19.36 pounds of ammonium sulphate, and 10.56 gallons of tar are produced per ton of coal.

J. W. RICHARDS.

**Coke Drawing Machine.** BY G. T. WICKES. *Iron Age*, Aug. 10, 1905. (Read before the American Institute of Mining Engineers.)—Description of a machine which draws the coke from bee-hive coke ovens and loads it into the cars. Operated by one man, it can draw 30 ovens in a ten-hour day, requiring ten to twenty minutes to an oven. The total cost of operating the bee-hive oven with this appliance is 42 cents per oven per day, as against an average of 92 cents without it. The machine will undoubtedly decrease the cost of bee-hive oven coke, and is in line with the savings being obtained by similar substitutions in all lines of industry.

J. W. RICHARDS.

**Exhaustion of the World's Iron Ore Supplies.** BY N. S. SHALER. *International Quarterly*, August, 1905.—A discussion of the subject by a person who knows only part of the fundamental facts concerned, and their relations. The author predicts that about 50 years will see the exhaustion of the Lake Superior deposits and suggests that aluminium, being more abundant than iron, will step in to supply the demands, but at a higher cost of labor and effort. He thinks aluminium cannot be produced in the near future for less than 10 cents per pound. Readers are cautioned against the many errors in the article, arising apparently from the limited information of the writer.

J. W. RICHARDS.

**Operating a Charcoal Iron Furnace with Concentrates.** BY H. R. HALL. *Iron Age*, August 31, 1905. (Read before the American Institute of Mining Engineers.)—For five months the furnace used all concentrates, smaller than a 20-mesh sieve, using 1.6 tons of concentrates, 1980 pounds of charcoal, and 224 pounds of limestone per ton of pig iron made, producing 89 tons of iron per day, while 6 per cent. of the concentrates charged were carried off with the gases. The blast averaged 43 cubic feet per pound of fuel burned. Using coke, the same furnace

produced only 60 tons of iron per day, consuming 1 ton of coke per ton of iron produced, 25 per cent. of the charge being carried over with the gases. The writer prefers running with charcoal when it can be had, and thinks it has some unexplained advantages over coke.

J. W. RICHARDS.

**Converting Fine Iron Ores into Nodules** *Iron Age*, September 7, 1905.—Description of the plant of the National Metallurgic Co., at Hackensack Meadows, N. J., using the process of T. C. King. The substance now being treated is pyritic residues or cinder, resulting from burning Newfoundland pyrites at sulphuric acid works. It is mixed with some warm tar, and fed into a revolving cement-burning kiln, operated by powdered coal, 100 feet long, 6 feet inside diameter, and in which the ore remains ninety minutes before being discharged at a white heat. The capacity is 200 tons in twenty-four hours. It is suggested to treat Lake Superior fines at the mines, in this manner, removing their 12 per cent. of water and putting them in fine shape for reduction. No estimate of costs is given. They would probably be prohibitive.

J. W. RICHARDS.

**Smelting of Oregon Magnetic Iron Ore by Electricity.** *Iron and Machinery World*, December 23, 1905. (From the report of D. T. Day, United States Geological Survey.)—In October last, C. E. Wilson erected an electric furnace to test the magnetic sands of the Pacific beaches. Those used contained 79.06 per cent.  $\text{Fe}_3\text{O}_4$ , 16.00  $\text{TiO}_2$ , 2.45  $\text{MnO}_2$ , 2.49  $\text{SiO}_2$  and moisture, etc. An alternating current of 2,300 volts was transformed to direct of 20 to 50 volts, and 1,000 to 2,000 amperes. The crucible was  $18 \times 18$  inches  $\times$  24 inches deep, lined with fire-bricks. The charge 200 pounds of magnetic sand, 44 pounds Fairfax coke (25 per cent. ash), 24 pounds of lime. 150 pounds of this were treated per hour, producing 70 pounds of steel. The slag contained 8 per cent. iron and 53 per cent.  $\text{TiO}_2$ . No titanium went into the iron. With a larger furnace, 4 feet inside diameter by 4 feet deep, a capacity of 2,000 pounds of steel in twenty-four hours was attained, using 125 volts at 1,200 amperes (200 horsepower). With experience, it is believed that good steel, low in carbon, can be commercially made.

J. W. RICHARDS.

**The Failure of Blast-furnace Linings.** By H. B. WEAVER. *Iron Age*, August 17, 1905.—The author discusses the causes of fire-brick linings failing and melting at points where the temperature is far below that of ordinary slag formation. He ascribes the action to volatilized alkali salts, and suggests that the use of a ring of basic lining at the zone attacked might be practicable and remove the difficulty.

J. W. RICHARDS.

**The Melting-Points of Slags and Other Members of the Series  $\text{SiO}_2\text{-Al}_2\text{O}_3\text{-CaO}$ .** BY C. RICHARDSON. *Iron and Steel Mag.* October, 1905.—A criticism and review of the work of Boudouard in France and Vogt in Norway. The melting-points of both these investigators are suspiciously low, and where they give data for compounds whose melting-points are accurately known, such as for anorthite, they are some  $300^\circ$  too low, as shown by the exact determination by Day and Allen, for the Carnegie Institute ( $1532^\circ$ ). A very grave doubt is thus thrown upon the accuracy of all the temperature measurements of these investigators.

J. W. RICHARDS.

**Open-Hearth Furnace Comparisons.** BY A. D. WILLIAMS, JR. *Iron Age*, September 21, 1905.—One modern improvement has been to raise the height of the roof, so as to get greater space for the flame and so increase heating by radiation. The increase of length in proportion to width gives better utilization of the fuel, in large furnaces. The hearth area per ton of steel is now 8 to 10 square feet, the width is limited to 15 feet, because of difficulties with the arch, but the length has been increased to 40 feet. The air regenerator is made 30 to 60 per cent. larger than the gas regenerator; the total volume of one pair is 50 to 100 cubic feet per ton of capacity. The greater the depth, the better the regenerators work.

J. W. RICHARDS.

**Tensile Strength of Open-Hearth Steel.** BY M. MERRIMAN. *Iron and Steel Mag.* November, 1905. (Read before the American Institute of Mining Engineers.)—A discussion of Campbell's formulas for the tensile strength, in which the expression  $x \text{ Mn}$  occurs, the value of  $x$  being taken from a supplementary table. It is shown from the supplementary table, however, that  $x \text{ Mn}$  varies with the amount of carbon and manganese present according to the formula  $x \text{ Mn} = 8 \text{ C.Mn} - 320 \text{ C.}$ , using which the strength of acid steel becomes

$$40,000 + 680 \text{ C} + 1,000 \text{ P} + 8 \text{ C.Mn},$$

and for basic steel

$$38,800 + 650 \text{ C} + 1,000 \text{ P} + 90 \text{ Mn} + 4 \text{ C.Mn}.$$

To express more clearly the effect of carbon, the formulas may be written

$$\text{For acid steel, } 40,000 + (680 + 8 \text{ Mn}) \text{ C} + 1000 \text{ P},$$

$$\text{For basic steel, } 38,800 + (650 + 4 \text{ Mn}) \text{ C} + 1000 \text{ P} + 90 \text{ Mn},$$

from which it appears that each 0.01 per cent. of carbon increases the tensile strength of acid steel  $680 + 8 \text{ Mn}$  pounds, and of basic steel  $650 + 4 \text{ Mn}$  pounds. The formulas also show that each 0.01 per cent. of manganese increases the tensile strength of acid steel  $8 \text{ C}$  pounds, and of basic steel  $90 + 4 \text{ C}$  pounds (C, P, and Mn represent in each case 0.01 per cent.)

J. W. RICHARDS.



**Hot Cracks in Steel Castings.** BY A. SIMONSON. *Iron and Steel Mag.* October, 1905. (From *The Foundry*.)—To reduce these cracks, the mould should be hard-faced but yet yielding. The hard, refractory skin is made by washing with silica flour and molasses water; the mold (of silica sand and clay) should be rather overdried than underdried; if only just dry it is in the most unyielding condition, if baked more it becomes weaker, and should give way as soon as the cooling casting becomes rigid enough to support itself and begins to shrink. The core should be equally carefully made; the skin should be made by washing with silica flour, Ceylon graphite and molasses water, and the core baked till the interior is thoroughly "rotten." The skin holds the core together and is very rigid, although only one thirty-second inch thick, while the interior collapses easily when outside pressure comes on the core. The metal must be of such composition as not to be red-short, which requires that sulphur and copper particularly should be low; the two together are especially fatal.

J. W. RICHARDS.

**Protection of Iron by Paper.** BY L. H. BARKER. *Iron and Machine World*, September 2, 1905. (Read before the American Society for Testing Materials.)—Experiments in protecting iron and steel by paints, showed that a coating was required entirely impervious to water, and that by first cleaning the iron with a scratch brush, putting on a sticky paint, wrapping around this paraffined paper, and then painting on the paper, a highly protective coating is obtained. The experiments lasting three years have shown very satisfactory results, especially in places exposed to smoke and gases, the iron being perfectly protected.

J. W. RICHARDS.

**Action of Acids on Iron in Pickling.** BY C. F. BURGESS. *Electrochem. Metal. Ind.* September and October, 1905.—A long and systematic review of this important subject. The ideal pickle should remove the coating without attacking the underlying metal, and should therefore exert a maximum solvent action on the oxide and a minimum on the metal. The rate of corrosion of iron increases with the concentration up to a certain limit, and then decreases; temperature increases the activity, but less for charcoal pig-iron and hardened cast-iron than for other varieties. The addition of soluble salts of copper, platinum, and certain other metals greatly increases the action; arsenic decreases the action. The magnetic oxide of iron, or iron scale, is soluble only in hydrochloric acid. Sulphuric acid solution becomes "spent" while there is yet considerable free acid unused; hydrochloric acid solution retains activity till almost completely neutralized. No experimental data have yet been published comparing the two acids in these respects. Great improve-

ments could be made if more attention were paid to the density of the acid solution used and to its temperature. Allowing the detached scale to lie in the bottom of the tank causes great waste of acid, because it slowly dissolves. It should be removed either continuously or at frequent intervals. Automatic machinery should be largely introduced for cleaning, brushing and drying. Electrolytic corrosion, using the iron as anode, is not effective because of the absence of evolution of gas, which detaches the scale. If used as cathode, the hydrogen is evolved on the surface of the scale and therefore does not lift it off. The pickling operation has so many drawbacks that the use of the sand-blast for detaching scale is increasing.

J. W. RICHARDS.

**Arsenic in Pickling Solutions.** BY C. F. BURGESS. *Electrochem. Metal. Ind.* October, 1905. (Read before the American Electrochemical Society.)—A 5-times normal solution of sulphuric acid was taken, and to it was added a fraction of 1 per cent. of arsenic. In one hour, the arsenic-free solution dissolved 34 times as much iron; during the first twenty minutes 9 times, and during the last forty minutes 94 times as much, showing that the arsenic acts most strongly in the more nearly neutralized acid. Also, less hydrogen is evolved when arsenic is present, which may be an advantage when pickling piano wire, clock springs, measuring tapes, etc., which are rendered brittle by the hydrogen. Such articles can be pickled in a solution containing arsenic, and when subsequently nickel-plated are found to be stronger than if pickled in pure acid.

J. W. RICHARDS.

**Theory and Use of Fluxes in Melting Copper Alloys.** BY E. S. SPERRY. *Brass World*, September, 1905.—The use of the flux is to remove oxides and then to protect the metal from further oxidation, but it should not attack the crucible or furnace lining. Finely divided metals cannot be melted down without fluxes, and better metal is in any case obtained with a proper flux than without any. *Sal ammoniac* is the best flux for melting zinc, but is of no advantage in melting copper, bronze, brass or German silver, or silver or gold. *Borax* is excellent for most metals, particularly for copper and German silver. It attacks crucibles, but not so badly as fluorspar. It costs, with water counted off, about 14 cents per pound. *Plaster of Paris* ( $\text{CaSO}_4$ ) melts at redness, dissolves oxides and silica, and is an excellent brass flux, while it attacks the crucible less than any other flux. It detaches itself easily from both the metallic ingot and the mold. *Potassium cyanide* is excellent for tin, lead or copper, or their alloys, but is expensive, very poisonous, and attacks crucibles strongly. *Common salt* is universally used in melting brass. It reduces copper oxide to the metallic state (?). A double handful is added to a crucible charge. The slag is viscous, should be

skimmed off, but does not strongly attack the crucible. *Soda ash* and *bicarbonate of soda* dissolve sand, clay and silicious materials, including the crucible. They are not recommended for use alone, but mixed with sand form a better flux. *Glass* is pulverized and usually put in the bottom of the crucible, with the charge on top. It does not act strongly on metallic oxides, and serves mainly as a cover for the metal. It has a high melting-point, and is inferior to common salt and several other fluxes. *Boric acid* is similar to borax, but possesses no advantages commensurate with its much higher cost. (It is particularly active in dissolving lead oxide.—Abstractor.) *Corrosive sublimate* ( $\text{HgCl}_2$ ) has been proposed for copper, copper alloys, gold and silver, but its use is of no practical advantage. *Lime* (chalk, marble, oyster shells) are only useful for fluxing large quantities of sand and iron oxide, and the slag is frequently, even in these cases, difficultly fusible. *Yellow prussiate of potash* ( $\text{K}_4\text{Fe}_6\text{N}_6\text{C}_6$ ) acts like potassium cyanide, being particularly useful in making copper castings. It is apt to introduce iron into the metal, if kept too long in the furnace in contact with the metal. It is excellent for bronze or German silver, using 2 pounds to 100 of metal, and adding after melting just before pouring. It is stirred into the metal, the whole let rest for five to ten minutes, the slag skimmed and the metal poured. *Salenixum* ( $\text{KHSO}_4$ ) is used in melting gold and silver sweeps, as it dissolves iron. It, or salt cake,  $\text{Na}_2\text{SO}_4$ , cannot be recommended for copper alloys, on account of sulphur given to the metal. *Nitre* is the best flux for gold, silver or copper; in the latter case it first oxidizes copper, forming  $\text{KNO}_3$ , but afterwards the graphite of the crucible reduces potassium (or sodium) into the metal and strongly reduces it. It is largely used for German silver, but rarely for brass, except in connection with borax and manganese dioxide. It fluxes sand and clay, and strongly attacks crucibles, sand or graphite. *Cryolite* attacks silica and siliceous materials strongly, but penetrates crucibles. It should be used in connection with lime, to make it more viscous. It does nothing which fluorspar cannot do as well, at less cost. *Sandiver* is refuse from glass works, mostly silicate of soda and lime; it is somewhat useful in melting brass, but is inferior to a mixture of lime and fluorspar. *Fluorspar* is the best flux for general use, since it dissolves oxides and also silica or silicious materials. For melting washings, grindings or similar brass refuse, it is unequaled. Alone, it penetrates the crucible and strongly attacks it, and it should be mixed with lime whenever practicable. By increasing or decreasing the lime, any degree of fluidity may be produced. The lime tends to remove sulphur from metals; it is on this account very useful for German silver. It is cheap; a good mixture is 3 of lime to 1 of fluorspar; this slag is thick enough to be skimmed off easily. The quicklime is first slaked in a box, fluorspar



mixed in with a hoe, and the whole then allowed to set and broken up for use into small lumps, of which 2 to 3 pounds are used per 100 of metal. *Mixed fluxes* are of doubtful value. A good one used for German silver contains 1 part nitre, 2 borax, 4  $\text{MnO}_2$ . Used in a graphite crucible, manganese is reduced into the metal, improving very much its solidity:

J. W. RICHARDS.

**Welding Copper.** BY E. S. SPERRY. *Brass World*, September, 1905.—Microcosmic salt is heated until all the water (and ammonia) are driven off, and the clear melted salt poured onto a flat surface and broken up when cold. The glass is pulverized, and sprinkled on copper in the same manner as borax is used in welding iron. A coal or coke fire must not be used, since the carbon will reduce phosphorus into the copper and make it brittle; gas is therefore used, and the welding performed as with iron.

J. W. RICHARDS.

**Manganese Bronze and Its Manufacture.** BY E. S. SPERRY. *Brass World*, December, 1905.—Commercial manganese bronze consists of two grades; first the mixture for rolling, drawing or forging, containing essentially 60 per cent. copper, 37.5 zinc, 1.5 iron, 0.75 tin, and 0.01 to 0.02 manganese; secondly the mixture for sand castings, containing 56 per cent. copper, 41 zinc, 1.5 iron, 0.75 tin, 0.01 manganese and 0.5 aluminum. The strongest copper-zinc alloy contains 55 copper to 45 zinc, the iron present in the bronze raises the strength and elastic limit, the 0.5 to 0.75 per cent. tin increases the strength and makes the elastic limit more definite, the aluminum is absolutely necessary for making sand castings. No lead should be present, and therefore refined zinc must be used. The manganese serves only as the carrier of the iron, as without its mediation the iron would not alloy with the copper. The ferromanganese used is first melted with 4.5 times its weight of wrought iron and 2.5 times its weight of tin, the crucible being well covered, and using a plumbago stirrer. The melt is poured into small bars or strips. This "steel alloy," as it is called, is melted, for sand castings, with other ingredients in the following proportions: Copper 56 pounds, Bertha zinc 43, "steel alloy" 2, aluminum 0.5 pounds. One-third of the copper is first melted, the steel alloy added, the aluminum added, the remainder of the copper, and lastly the zinc. Care must be used not to overheat, and the metal must not be allowed to "soak," but the molds must be ready before the metal is melted, so that it can be poured as soon as melted; metal poured as cool as possible is the best. Test bars cast in green sand usually give 70,000 pounds tensile strength, 30,000 elastic limit, 18 per cent. elongation in 6 inches and 26 per cent. reduction of area. For sheet, the mixture melted consists of copper 60 pounds, zinc 39, "steel alloy" 2. The copper is melted, the alloy added, and lastly the

zinc; it is cast in iron moulds like brass. More "steel alloy" gives a harder metal, with less elongation and reduction of area. The manganese does its work in causing the iron to alloy, and deoxidizing the copper; it has no other function, and is not an essential ingredient of commercial manganese bronze.

J. W. RICHARDS.

**Microstructure and Frictional Characteristics of Bearing Metal.** BY M. PRICE. *Iron and Machine World*, July 8, 1905. (Read before the American Society of Mechanical Engineers.)—The pure metals tested were aluminium, lead and copper, alloys of aluminium and copper with small amounts of magnesium, manganese or antimony, of tin with antimony, copper, bismuth or zinc, of copper with manganese, and lead with antimony and tin. With one or two exceptions, the alloys tested were not the ones commercially used as bearing metals. It is a pity that the copper-tin-lead alloys were not studied. The only conclusion from the study is that the behavior of a metal or alloy as a bearing metal can only be determined by its peculiarities as actually determined, and that there are no general laws or rules. These conclusions are not reliable.

J. W. RICHARDS.

**Silicon Copper Spring Wire.** *Brass World*, December, 1905.—The alloys with up to 4 per cent. of copper may be rolled into sheet or drawn into wire, with some difficulty, if the silicon is between 3 and 4 per cent. It gives perhaps the best spring metal of all the copper alloys. A 2.5 per cent. bronze wire, hard-drawn, showed a tensile strength of 130,000 pounds, elongation 2 per cent., reduction of area 17 per cent., and stood 24 twists in 6 inches. The alloy soon tarnishes black, but only superficially. The electrical conductivity of this wire was only 9.3 per cent. that of copper.

J. W. RICHARDS.

**Brass Furnace Tests.** BY W. T. KRAUSE. *Iron Age*, September 21, 1905.—A record of comparative melting tests with coke crucible furnaces and the Steele-Harvey melting furnace, using fuel oil. In a four days' run, the comparison was as follows:

	Coke furnace.	Steele-Harvey furnace.
Loss of metal in melting (per cent.) .....	2.8	1.1
Life of crucible (heats).....	9	24
Average cost per 100 lbs. of metal.....	\$0.33	\$0.13

J. W. RICHARDS.

**An Acid-Resisting Metal.** *Brass World*, December, 1905.—The lead alloys resist acid best, but are too soft for many purposes. The best strong metal to use consists of copper 82 per cent., tin 8, lead 8, zinc 2, and to every 100 pounds of this mixture add 0.125 pound of 5 per cent. phosphor-tin, which amount must not be exceeded, or blow-holes will result. The phosphor-tin is added

last, the metal stirred and let stand a few minutes, then cast as the lowest heat at which it will run. This mixture is particularly useful for sulphite pulp mill fittings. J. W. RICHARDS.

**Victor Metal.** *Brass World*, December, 1905.—This is a white metal used largely for marine work because it withstands salt air and water, and has a whiter color than German silver. The following analysis shows its composition: Copper 49.94 per cent., zinc 34.27, nickel 15.40, aluminum 0.11, iron 0.28. The alloy may be made by using copper 50 pounds, zinc 35, nickel 15, aluminum 2 ounces. The nickel and copper are melted together under borax, then aluminum added, and lastly the zinc. It is improved by remelting. It cannot be rolled.

J. W. RICHARDS.

**Composition of Trolley Wheels.** BY G. H. CLAMER. *Brass World*, September, 1905.—The author approves of the alloy 92 copper, 6 tin, 2 zinc as the best. Experiments to introduce lead, to reduce friction and wear, showed that the wear was increased, in every instance. The bushings should be of strong, tough metal, so as to withstand the pounding of the wheel; for this reason, alloys with much lead are unsuited also for the bushings.

J. W. RICHARDS.

**Britannia Metal Mixture.** *Brass World*, September, 1905.—A. E. Hobson introduces 0.02 to 0.2 per cent. of manganese into Britannia metal, claiming it gives a finer grain and better finish. It is introduced by melting together 1 part of 20 per cent. manganese copper, 2 parts copper, 9 parts antimony and 109 parts of tin.

J. W. RICHARDS.

**New Alloys.** *Brass World*, October, 1905.—A new soft bearing metal, used for lining car boxes, contains by analysis 80.65 per cent. lead, 11.40 tin, 7.53 antimony, 0.42 copper. A bronze called "needle metal" runs so thin that it is said needles could almost be cast from it. It contains copper 84.96 per cent., tin 7.96, zinc 5.31, lead 1.77. Pattern bronze, having the most desirable qualities for making patterns, is best made of copper 90 per cent., tin 6.00, zinc 2.50, lead 1.50. It casts sharply, is stiff and files well.

J. W. RICHARDS.

**Electrolytic Nickel.** *Brass World*, November, 1905.—The Orford Copper Company are again selling electrolytically refined nickel. The electrolyte used is understood to be nickel chloride solution; the sheet nickel cathodes are rubbed with graphite, and the deposit stripped off when about one-fourth inch in thickness. The plates are 3 feet by 4 feet, and are so tough that they must be cut by power shears. The metal is 99.25 to 99.85 per cent. nickel; 99.50 as an average. Being free from sulphur and



carbon it is preferable to ordinary nickel, since these impurities are very deleterious to German silver and like alloys.

J. W. RICHARDS.

**The Manufacture of Nickel Anodes.** BY E. S. SPERRY. *Brass World*, October, 1905.—The nickel is melted in graphite crucibles of regular steel-pot mixture, in a coal or coke fire, using blast. If new nickel is used, it is improved by melting it twice, putting some charcoal into the crucible, so that it absorbs carbon and becomes "cast"-nickel, analogous to cast-iron. In this condition it is more easily dissolved. In a No. 40 crucible, about 3 heats per day, of 100 pounds each, can be obtained. Iron is usually put in, from 3 to 20 per cent.; broken files are convenient material, and some 4 per cent. of tin is also added. For flux, a mixture of 3 parts lime and 1 part fluorspar, mixed together, moistened and set in lumps, is used to the extent of about 1 per cent. Tin is put in only on the last remelting. The molds are of ordinary sand, dried, clamped together hot, and used at once. Oxide, scale and sand are removed from the castings by the sand-blast; the roughened surface corrodes evenly without becoming "passive." A cheap grade of nickel answers for anodes. Orford shot nickel contains 97.22 nickel, 1.92 iron, 0.20 copper, 0.10 sulphur, and 0.55 silicon, carbon, etc. (F. P. Dewey). Analyses of the commercial anodes show:

Per cent. anodes.	Nickel.	Iron.	Tin.	Silicon.	Copper.	Carbon.
90	90.13	4.67	3.20	1.12	0.09	0.79
85	81.11	12.15	4.01	1.56	0.19	0.98
80	77.72	15.16	3.89	2.17	0.11	0.95

The iron tends to produce local action and prevent the nickel from absorbing oxygen and becoming passive. Tin makes the alloy more fusible, gives a sharper casting, and makes the anode finer-grained and more easily soluble. Carbon makes the nickel more fusible and gives a better casting. Copper is a harmful ingredient, and makes a streaked, discolored plating. Silicon makes a sounder casting; it is reduced from the silica of the crucible, and comes in with the iron. Aluminum gives a solid casting, but is not used because it makes a dirty scum near the gate. Rolled nickel anodes do not corrode evenly, become streaked and pitted, and dissolve with difficulty. They produce but little slime and keep the bath cleaner. The iron and tin of cast anodes dissolve, but settle from the bath as hydrated oxides.

J. W. RICHARDS.

**Manganese in Nickel Alloys.** *Brass World*, October, 1905.—Manganese is not so powerful a deoxidizer as aluminum or silicon, but it is powerful enough to reduce any oxides of copper, nickel or zinc present, while the film of MnO on the stream of metal is reduced back to Mn by the oil burning at the mouth of the mold.

Since aluminum and silicon oxides are not reduced back to metal by the burning oil, they remain as scum, which dirties the casting. Manganese also has the greatest affinity for sulphur of any metal, and so removes traces of it from the bath, floating off as sulphide. It is introduced as 20 per cent. manganese copper. In German silver 0.05 per cent. of manganese is introduced, in cupro-nickel, 0.10 per cent. J. W. RICHARDS.

**The Thermite Process in American Practice.** By E. STÜTZ. *Iron and Steel Mag.* September, 1905.—The article contains interesting data and illustrations of recent uses of thermite. Among them are tests by Dr. Moldenke, of malleable iron bars cast after titanium thermite had been immersed in the ladle, and some cast without this treatment. The average tests showed an increase of 8 per cent. in the strength. J. W. RICHARDS.

**Aluminium as a Reducing Agent.** By O. P. WATTS. *Electrochem. Metal. Ind.* October, 1905. (Read before the American Electrochemical Society.)—To produce pure titanium and tungsten the author mixes up the charge of oxide with powdered aluminium, adding cryolite or fluorspar to moderate the reaction, places in the cavity of a furnace with magnesia lining and starts an arc just above the charge, using 300 amperes at 70 volts for five minutes and 600 amperes at 80 volts for five minutes more. The reduction is vigorous but never explosive, although as much as 350 grams of aluminium are used in a charge. Oxide of molybdenum, titanium and tungsten were thus reduced, with the auxiliary heating of the electric arc. J. W. RICHARDS.

**Aluminium Skimmings.** *Brass World*, November, 1905.—When melting aluminium, a large amount of dross or skimmings forms, which is an intimate mixture of metal and oxide. Its formation cannot be avoided, but it can be afterwards melted down by itself with a suitable flux, and much of its metal recovered. Cryolite acts as a good flux, but it is expensive. Common salt gives good results, but acts better if mixed with an equal amount of fluorspar; this mixture acts only slightly on the crucible at the low red heat used. J. W. RICHARDS.

**Crystallization of Tin Aluminum Alloys.** *Brass World*. October, 1905.—Tin containing 20 per cent. aluminum rolls out into thin ribbon which is tough and pliable. Twenty-four hours after rolling, it has crystallized until it is as brittle as glass, falling apart to small pieces by its own weight. Aluminum soldered with tin rapidly develops a brittle joint. An ingot of this alloy cracks all over and bends out of shape, becoming brittle and useless. Several good photographs illustrate the subject.

J. W. RICHARDS.

**Electric Zinc Smelting.** By O. W. BROWN and F. W. OERSTEL. *Electrochem. Metal. Ind.* October, 1905. (Read before the American Electrochemical Society.)—The reaction  $\text{ZnS} + \text{CaO} + \text{C} = \text{Zn} + \text{CaS} + \text{CO}$  takes place readily and completely, in an electrically heated retort, the impure fused calcium sulphide remaining containing only 0.13 per cent. of zinc. The reaction  $2\text{ZnS} + 2\text{CaO} + 7\text{C} = 2\text{Zn} + 2\text{CaC}_2 + \text{CS}_2 + 2\text{CO}$  takes place readily, 50 amperes at 30 volts for two hours sufficing for 390 grams of charge, the residue containing only 0.036 per cent. of metallic zinc. The reaction  $2\text{ZnS} + \text{CaO} + 4\text{C} = 2\text{Zn} + \text{CaC}_2 + \text{CS}_2 + \text{CO}$  takes place, only 0.1 per cent. of zinc being left in the residue, which is commercial calcium carbide. This mixture, weighing 7.06 kilograms, was treated in six hours and forty minutes by a current of 172 amperes at 68 volts. The reaction  $2\text{ZnS} + \text{SiO}_2 + 4\text{C} = 2\text{Zn} + \text{SiC} + 2\text{CO} + \text{CS}_2$  does not take place, either in a coke fire heat or by treating 502 grams in an electric furnace heated by 6 kilowatts for one hour, although most of the charge was volatilized from the crucible. The authors conclude that the first three reactions are commercially practicable, and that in a few years the electric furnace will be largely employed in the zinc industry.

J. W. RICHARDS.

**Electro-Galvanizing Wire.** *Brass World*, October, 1905.—The wire is passed through the zinc chloride or sulphate electrolyte at the rate of 100 feet per minute, and a current density of 1000 amperes per square foot of cathode surface is used. The high speed gives the same effect as a rotating cathode, and renders possible the very high current density. The anodes are carbon, and have seven times the surface of the cathode. Air blown through helps to circulate the solution and to precipitate iron.

J. W. RICHARDS.

**Parting of Bullion.** By F. D. EASTERBROOKS. *Electrochem. Metal. Ind.* October, 1905. (Read before the American of Electrochemical Society.)—A discussion of the relative merits of parting by sulphuric acid and by electrolysis. Where the bullion is high-grade and interest charges must be considered, the acid parting is advantageous because it takes only twenty-four to thirty hours, as against several days for the other. The acid parting does not eliminate tellurium from the silver, and not over 0.05 to 0.06 per cent. of it can be tolerated in metal for rolling. In cupelling the precipitated silver after acid parting, selenium is oxidized and removed quickly, but tellurium only after several hours' refining. In electrolytic parting by the Balbach apparatus, about 32 per cent. of the daily output is held permanently in stock in electrolyte and contacts; in the Moebius tank about 41 per cent. The average ampere efficiency is 93 to 94 per cent.; current densities of 20 to 25 amperes per square



foot are used. All gold and tellurium remain in the slimes. Betts uses only 10 amperes per square foot, and deposits the silver in solid form. The fineness of the gold from either method of parting is 99 per cent. or over, and since the government refines it further at charges of 0.6 to 0.9 cent per ounce, there seems to be no chance for outside use of the Wohlwill process of refining, since outsiders would have interest charges to pay, and the Government does not.

J. W. RICHARDS.

**Iridium Sheet and Tubes.** *Brass World*, December, 1905.—H. C. Parker is said to make these by using iridium-ammonium chloride, mixed with an equal volume of sal ammoniac, the mixture being packed inside a fused quartz tube and heated by a blast-lamp. The iridium is said to deposit on the interior of the tube, and when cold can be detached and slipped out. If cut lengthwise, it makes a sheet.

J. W. RICHARDS.

**Electrometallurgy of Antimony.** [By A. G. BETTS. *Electrochem. Metal. Ind.* October, 1905. (Read before the American Electrochemical Society).]—Crude antimony trisulphide is attacked by an acid solution of ferric chloride; the solution is then electrolyzed with carbon anodes and copper or lead cathodes, ferric chloride being regenerated, which collects at the bottom of the cell as a heavy layer, and may be tapped off. The efficiency of deposition is 90 per cent. Copper is the most troublesome impurity, existing as cuprous chloride in the chloride solution, in which it lies close to antimony in the electromotive force series. Antimony trifluoride is suitable as an electrolyte, particularly for refining antimony, the anodes dissolving readily and the antimony depositing finely. Such deposits are very resistant to tarnish by acid fumes.

J. W. RICHARDS.

**Metal Deposition.** By A. G. BETTS. *Electrochem. Metal. Ind.* October, 1905. (Read before the American Electrochemical Society).—A discussion of the effect of colloids, reducing agents, strength of acid, alkalinity of base, etc., on the physical properties of electrolytically precipitated metals. One generalization proposed was that the harder a metal the better it deposits electrically; but in the discussion it was shown that the rule could not stand. Another was that metals with high valencies tended to form the best deposits, but the validity of this rule was also questioned. The surface tension was also proposed as tending to smooth out the deposit when the tension was high. The long paper contains a multitude of details impossible to abstract satisfactorily.

J. W. RICHARDS.

## ORGANIC CHEMISTRY.

### **Solubility and Specific Rotatory Power of Carbohydrates and Certain Organic Acids and Bases in Pyridine and Other Solvents.** BY JOSEPH GERARD HOLTY. *J. Phys. Chem.* **9**, 764-779.

—The author summarizes as follows: The order of solubility of the investigated substances in pyridine, beginning with the most soluble, is as follows, the figures indicating parts by weight contained in 100 parts by weight of solution: Fructose, 18.49; malic acid, 14.60; glucose, 7.62; cane-sugar, 6.45; galactose, 5.45; erythrite, 2.50; lactose, 2.18; strychnine, 1.23; mannite, 0.47. Saturated solutions of cane-sugar, glucose, fructose, and galactose in pyridine show a greater specific rotatory power than solutions of the same concentration in water. The greatest difference appears in the case of fructose, while for galactose the difference is very slight. The differences in the case of cane-sugar and glucose are intermediate between the other two mentioned above. On the other hand, the substances which show a less specific rotatory power in concentrated solutions in pyridine as compared with solutions of same concentration in water are, lactose, mannite, strychnine and malic acid. Of these, the greatest difference appears in the case of malic acid, the difference decreasing with strychnine, mannite and lactose in the order named.

V. J. CHAMBERS.

**On Colored and Uncolored Diimines.** BY HANS H. PRINGSHEIM. *Ber.* **38**, 3354-3356.—The author continues the examination of the green body obtained by Jackson and Calhane by the action of bromine on 2,6-dibrom-*p*-phenylenediamine, or *p*-phenylenediamine itself, and shown by them to be a mixture of 2,6-dibrom-*p*-phenylenediamine hydrobromide and 2,6-dibrom-*p*-phenylenediimine hydrobromide. No extensive decomposition is produced by the action of bromine on 2,6-dibrom-*p*-phenylenediamine, as reduction with hydrogen sulphide regenerates the original body. Fractional neutralization of the green salt gives unsatisfactory results, although a vivid green salt is obtained containing a large percentage of the diimine hydrobromide. Oxidation of 2,6-dibrom-*p*-phenylenediamine in dry ether by lead peroxide, followed by treatment with dry hydrochloric acid, gives a salt that, because of its slight color, was not thought encouraging. Later, Willstätter obtained an uncolored diimine and its hydrochloride by a similar treatment of *p*-phenylenediamine with lead oxide, etc. It is probable therefore that the light colored substance obtained by the author was really the diimine salt sought. As the green precipitate contains the diimine hydrobromide as one of its components there appear to be two isomers possible, a colored and an uncolored one.

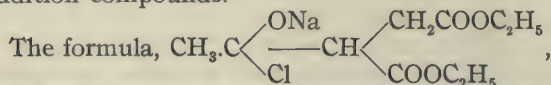
V. J. CHAMBERS.

**On the Decomposition Products of Epinephrin Hydrate.** By JOHN J. ABEL AND R. DEM. TAVEAU. *J. Biol. Chem.* **1**, 1-32.—Determinations of the nitrogen content of various samples of epinephrin hydrate, obtained at different times from different lots of fresh glands and purified by various methods, showed a lack of agreement but approaching more nearly  $C_{10}H_{13}NO_3 \cdot \frac{1}{2}H_2O$  (Abel) than  $C_{19}H_{18}NO_3$ , thus showing that objections to the Abel formula based on nitrogen values are not well founded. Ammonia and methylamine were shown to be decomposition products of epinephrin hydrate when it was rapidly boiled with water or with water containing potassium hydroxide. Small amounts of skatol, protocatechuic aldehyde and vanillin were also obtained by various methods. The latter was obtained by methods that excluded the possibility of its being formed by methylation of protocatechuic aldehyde as suggested by Stolz. This indicates that the residues of both vanillin and protocatechuic aldehyde are present in the epinephrin. The gold salt of the base  $C_8H_9N_2O$  obtained from epinephrin gave methylhydrazine, ammonia and probably methylamine when decomposed with strong alkali. The above observations are then used in "Objections to the formula  $C_6H_3(OH)_2CH.OH.CH_2NHCH_3$  now generally accepted as most probably representing the constitution of our substance." Some synthetic experiments were undertaken to get physiologically active compounds having one or two hydroxylated benzene nuclei associated with a nitrogenous complex containing two nitrogen atoms. Methylhydrazine and  $\beta$ -iodopropionic acid gave a white viscous substance, possibly the hydrazide. This reacted easily with protocatechuic aldehyde, vanillin, and with chloracetonepyrocatechol, the compound formed from the last being brown, viscous and non-crystalline, but its aqueous solution, of proper concentration, induced a prolonged and complete constriction of the conjunctival vessels. An atmosphere of hydrogen was used throughout the work whenever oxidation was at all possible. V. J. CHAMBERS.

**Contribution to the Knowledge of the Processes in Syntheses with Sodium Malonic Ester and Related Bodies.** By ARTHUR MICHAEL. *Ber.* **38**, 3217-3234.—The author obtains the intermediate addition products of the action of alkyl halides on sodium malonic ester and related bodies. This is followed by theoretical deductions as to the relative positions of the alkyl radical and the halogen in such addition products. A series of experiments are then given bearing on the validity of such deductions. Ethyl chloracetate acts on sodium malonic ester in dry ethereal solution in the normal way with precipitation of sodium chloride. In benzene solution, however, an addition product is formed. The sodium derivative goes slowly into solution, the solution becoming yellow and neutral. Practically



no sodium chloride is separated. Similar addition products are formed from ethyl chloracetate and the sodium derivatives of ethyl-, methyl- and propylmalonic ethyl esters, acetoacetic and ethylacetoacetic ethyl esters. Ether can also be used as a solvent in these cases but the solutions are not as stable as with benzene. The solutions of the addition products are unstable, but the stability increases with the carbon content and the basicity of the sodium derivative used. Water causes the precipitation of sodium chloride at once. Methyl and ethyl alcohols act more slowly. Dry carbon dioxide has no effect, but organic acids, hydrochloric acid, acetyl chloride and iodine cause decomposition with varying degrees of rapidity. Heating in a sealed tube to  $150^{\circ}$  causes little change, but higher temperatures cause decomposition. Evaporation of the solvent at a moderate temperature leaves oily products that are less stable than the benzene solutions. The positions of the halogen and radical could not be experimentally determined because of the instability of these addition compounds.



given for the addition compound from sodium acetoacetic ester, may be derived from the energy and affinity relations and agrees with the law of entropy. In this compound the positive energy of the metal is neutralized without sodium chloride being formed. The entrance of sodium into the acetoacetic ester molecule changes the affinity relations of the O and C atoms toward the alkyl group of the alkyl halide. It has been experimentally shown that the reaction,  $\text{R.CO.CH}_2\text{R}_1 + \text{Na} = \text{R.C(ONa):CHR}_1 + \text{H}$ , can take place only when the affinity of the metal for the oxygen of the carbonyl group exceeds that of the hydrogen for the methine group. The entrance of sodium into the molecule alters not only the affinity relations of the oxygen and the carbon but causes a change in the division of the potential energy of the atoms, so that by the elimination of the carbonyl this energy passes to the C:C system and to the sodium. The introduction of oxygen or oxygenated radicals in place of the hydrogen diminishes the pronounced affinity of carbon for carbon with relation to negative influence. As the sodium neutralizes the negative action of R.CO and  $\text{R}_1$  so the methine carbon has greater affinity for alkyl. On the other hand, not only is the free energy of the oxygen changed in part to bound energy and heat, but its negative character and thereby its affinity to alkyl is greatly reduced by the influence of the metal. Another factor is whether the total energy of the atoms of the alkyl group is more fully changed to bound energy and heat by union with a methine carbon atom than with an oxygen atom. The introduction of alkyl in place of

methylene hydrogen of malonic ester diminishes the negative character of the compound, therefore the introduction of alkyl in place of methine hydrogen rather than on the oxygen causes the more complete atomic neutralization and change of the total energy of the  $C_nH_{2n+1}.CH-$  group and of the negative group to bound energy and heat. The substitution of hydrogen atoms in  $NaOCH_3$  and  $NaOC_2H_5$  by  $CO_2C_2H_5$  causes a loss in the free energy of the metal,  $NaOCH_3$  and  $NaOC_2H_5$  acting more easily with  $CH_3I$  and  $C_2H_5I$  than do the sodium derivatives of glycolic and lactic esters. Also the sodium derivative of tartronic ester is less active than that of lactic ester. Now sodium malonic ester can be regarded as sodium propylate with hydrogen replaced by acid groups, so the replacement of the sodium by alkyl must be more difficult than with the alcoholate. Experiment shows, however, that sodium malonic ester and sodium acetoacetic ester act more readily with  $CH_3I$  and  $C_2H_5I$  than do the alcoholates. *The C-syntheses from alkyl halides and compounds like sodium acetoacetic ester that have the metal united to oxygen, are, from the standpoints of energy relations and the neutralization law, not abnormal but normal process. Experimental.*—The addition compound from ethyl chloracetate and sodium malonic acid ethyl ester was made by preparing the sodium derivative in benzene solution and heating with the chloracetic ester on a water-bath until the solution reacted neutral. Careful evaporation of the solvent gave a yellow to yellow-red oil that began to decompose when heated to  $150^\circ$  and proved unstable toward reagents (see above). Similar compounds with similar properties were obtained from the ethyl esters of methylmalonic, ethylmalonic, propylmalonic, acetoacetic, and ethylacetoacetic acids. A study was made of the action of methyl and ethyl iodides on the sodium derivatives of methyl, ethyl, propyl and isopropyl alcohols, and lactic, glycolic, tartronic, malonic, and acetoacetic acid esters, the energy of such action being determined by speed of reaction and temperature changes.

V. J. CHAMBERS.

**The Transformation of Formhydroxamic Acid to Fulminic Acid. A Reply to L. Wöhler.** By H. C. BIDDLE. *Ber.* 38, 3858–3859.—Wöhler had failed to obtain silver fulminate by the method given by Biddle, who now shows it was because Wöhler had not exactly repeated his conditions.

V. J. CHAMBERS.

**On the Action of Bromine on Trimethylamine.** By JAMES F. NORRIS. *Ber.* 38, 3904–3906.—The substance obtained by Remsen and Norris by the action of bromine on trimethylamine was later given the formula  $(CH_3)_3NHBr.Br$  by Norris. Hantzsch and Graf recently gave it the formula  $(CH_3)_3NBr_2$ . The author repeats his earlier work and gives the following reasons for his formula: (1) The substance is also prepared by the action of bromine

on trimethylamine hydrobromide,  $(\text{CH}_3)_3\text{N.HBr} + \text{Br} = (\text{CH}_3)_3\text{N.HBr.Br}$ . (2) No acid is given off in (1) as would be by the equation  $(\text{CH}_3)_3\text{N.HBr} + \text{Br}_2 = (\text{CH}_3)_3\text{NBr}_2 + \text{HBr}$ . (3) The hydrobromic acid necessary in the preparation by the action of bromine on the amine is shown to be produced by a secondary reaction. (4) Analysis gives the formula  $(\text{CH}_3)_3\text{N.HBr.Br}$ , and water and potassium iodide take out half this bromine. Furthermore, a comparison of the author's substance with that prepared according to the directions of Hantzsch and Graf showed them to be different substances. The author's compound melted at  $117-119^\circ$  and was decomposed by water to a heavy red oil which went slowly into solution with evolution of bromine. The substance of Hantzsch and Graf melted at  $85-86^\circ$ . Water reacts on it slowly and no characteristic oil is formed. V. J. CHAMBERS.

**On Some Derivatives of Tetrachlororthobenzoquinone.** BY C. LORING JACKSON AND R. D. MACLAURIN. *Ber.* 38, 4103-4105. —Preparation and study of some of the derivatives of Zincke's tetrachlor-*o*-benzoquinone. *Hexachlor-*o*-quinopyrocatechol ether*,  $\text{C}_6\text{O}_2\text{Cl}_2\cdot\text{O}_2\cdot\text{C}_6\text{Cl}_4$ , was prepared by the interaction of tetrachlorpyrocatechol and the quinone; a red substance melting at  $300^\circ$ . Sodium amalgam reduces it to *hexachlordioxypyrocatechol ether*,  $(\text{HO})_2\text{C}_6\text{Cl}_2\cdot\text{O}_2\cdot\text{C}_6\text{Cl}_4$ ; white needles, melting-point  $290^\circ$ . An alcoholic solution of the quinone on addition of a similar solution of aniline gave a light brown precipitate of *anilinedichlordianilino-*o*-benzoquinone*,  $(\text{C}_6\text{H}_5\text{NH})_2\text{C}_6\text{O}_2\text{Cl}_2\cdot\text{C}_6\text{H}_5\text{NH}_2$ ; light brown needles from alcohol, melting at  $164-165^\circ$  with decomposition. A further addition of the quinone to the filtrate from the aniline addition product gave a yellow precipitate of *alcoholdichlordianilino-*o*-benzoquinone*,  $(\text{C}_6\text{H}_5\text{NH})_2\text{C}_6\text{O}_2\text{Cl}_2\cdot\text{C}_2\text{H}_5\text{OH}$ ; yellow plates melting at  $140-141^\circ$ . The aniline addition product gave the *dichlordianilino-*o*-benzoquinone*,  $(\text{C}_6\text{H}_5\text{NH})_2\text{C}_6\text{O}_2\text{Cl}_2$ , on repeated crystallization from a mixture of benzine and ligroin; purple red needles melting at  $194-195^\circ$ . The filtrate from the alcohol addition product on standing gave *chlordanilino-*p*-quinoneanil*,  $(\text{C}_6\text{H}_5\text{NH})_2\text{CHCl}(\text{:O})(\text{:N.C}_6\text{H}_5)$ ; black, broad needles, melting-point  $180^\circ$ . While methyl alcohol with tetrabrom-*o*-benzoquinone gave only three compounds, with tetrachlor-*o*-benzoquinone not less than seven compounds have been isolated.

V. J. CHAMBERS.

**A Reply to Störmer and Kippe.** BY ARTHUR MICHAEL. *Ber.* 38, 4137.—An article showing that Störmer and Kippe had misunderstood certain articles by the author relating to the course of the reaction when cinnamic acid ester is produced by adding water to the reaction product of sodium ethyl acetoacetate and benzaldehyde.

V. J. CHAMBERS.

**Is Protagon a Mechanical Mixture of Substances or a Defi-**



**nite Chemical Compound.** By EDWARD R. POSNER AND WILLIAM J. GIES. *J. Biol. Chem.* **1**, 59-112.—After an exhaustive historical treatment of the subject, details of experimental work are given leading to the following conclusions: Protagon is a mixture of substances. The character of the constituents has not yet been determined, but it is evident that a phosphorus-free substance or substances are associated with one or more substances containing relatively large proportions of phosphorus. Slight variations of the classical methods of preparation resulted in raising considerably the phosphorus content of some of the products. By fractionation at the same or different temperatures in 85 per cent. alcohol under conditions that could not effect chemical decomposition, protagon was split into products very dissimilar in phosphorus and sulphur content. Phrenosin, pseudocerebrin, and cerebrin appear to have been identical substances, the authors favoring the name phrenosin. It is probably invariably present in protagon. The term phrenosinic acid is proposed for the product called neurostearic and cerebronic acid. Paranucleoprotagon is no more definite in chemical properties than protagon itself. An extended bibliography is given.

V. J. CHAMBERS.

**On Orthoparadibromorthophenylenediamine.** By C. LORING JACKSON AND F. W. RUSSE. *Am. Chem. J.* **35**, 148-154.—Orthoparadibromorthophenylenediamine ( $\text{NH}_2=1.2$ ;  $\text{Br}=4.6$ ) was prepared by the reduction of 2,4-dibromorthonitraniline. From it were produced the hydrochloride, dihydrobromide, diacetamide and the quinoxalines from phenanthrenequinone and benzil. **EXPERIMENTAL.**—*Orthoparadibromorthophenylenediamine*,  $\text{C}_6\text{H}_2\text{Br}(\text{NH}_2)_2$ .—2,4-Dibromorthonitraniline was reduced with tin and hydrochloric acid or with zinc and acetic acid, the first method being preferable. Colorless slender prisms from dilute alcohol, plates from water, m. p.  $83^\circ$ . Soluble in the common organic solvents; slightly so in hot water. Both the crystals and the solutions of the same darken on exposure to the air. Derivatives: The *hydrochloride*,  $\text{C}_6\text{H}_2\text{Br}_2\text{NH}_2\text{NH}_3\text{Cl}$ , was prepared as a gelatinous precipitate by the action of hydrochloric acid gas on a benzene solution of the diamine. Decomposed by hot water or alkalis. Similar treatment with hydrobromic acid gave an unstable precipitate that was probably the *dihydrobromide*. It loses hydrobromic acid very easily on exposure to the air. *Orthoparadibromorthophenylenediacetamide* was obtained by the action of acetic anhydride on the diamine, long white needles melting at  $227-228^\circ$ . Soluble in ethyl or methyl alcohols, acetone, chloroform or acetic acid; sparingly so in benzene or ligroin. Soluble in strong hydrochloric acid but precipitated on dilution. Also soluble in strong nitric or sulphuric acids and in hot sodium hydroxide solution. *Orthoparadibromdiphenylenequinoxaline*,

(Orthoparadibromphenanthrophenazine),  $C_6H_2Br_2N_2C_2(C_6H_4)_2$ , prepared by the action of an alcoholic solution of the diamine on an acetic acid solution of the phenanthrenequinone, crystallizes from benzene in silky yellow needles melting at  $258^\circ$ . Soluble in hot benzene or chloroform, slightly so in alcohol, ether, acetone, or glacial acetic acid, insoluble in ligroin or water. Strong hydrochloric acid turns it yellow; fuming nitric or strong sulphuric acids give red solutions. *Orthoparadibromdiphenylquinoxaline*,  $C_6H_2Br_2N_2C_2(C_6H_5)_2$ , by the action of the diamine on benzil in alcoholic solution, crystallizes from dilute alcohol as long white needles melting at  $149-150^\circ$ . Solubilities about the same as the above quinoxaline. The diamine with tetrabrom-orthobenzoquinone gave a red, slightly tarry mass but no definite compound was isolated.

V. J. CHAMBERS.

**Secondary Arsines.** BY WILLIAM M. DEHN and BURTON B. WILCOX.—*Am. Ch. J.*, **35**, 1-54.—*Crude Cacodyl*.—"Cadet's fuming arsenical liquid," or crude cacodyl, which consists mainly of cacodyl oxide, together with cacodyl and cacodylic acid, may be easily reduced directly to dimethylarsine, the chief reactions being as follows:  $(CH_3)_2AsAs(CH_3)_2 + H_2 = 2(CH_3)_2AsH$ , and  $(CH_3)_2AsOAs(CH_3)_2 + 2H_2 = 2(CH_3)_2AsH + H_2O$ . *Reduction of Cacodylic Oxide to Dimethylarsine*.—This was accomplished by the action of amalgamated zinc dust and hydrochloric acid upon an alcoholic solution of the cacodyl oxide. Dimethylarsine is a colorless, mobile liquid, of cacodyl odor, b. p.  $35.6^\circ$  at 747 mm.,  $55^\circ$  at 1.74 atmospheres; sp. gr. at  $29^\circ$ , 1.213. Above  $10^\circ$ , it inflames spontaneously in the air, and differs in this respect from the primary fatty arsines. In general, its physical and chemical properties resemble those of methylarsine. *General Reactions of Dimethylarsine*.—Dimethylarsine reacts with the greatest ease with halogens, halogen acids or their salts with heavy metals, with oxygen, sulphur, oxides, sulphides, or with oxygenated acids or salts. Of its reactions with organic compounds, those with the alkyl halides, and those in which it acts as a reducing agent, have been most thoroughly studied. *Method of Controlling Reactions*.—On account of the spontaneous inflammability of the dimethylarsine, it was sealed up in small bulbs and placed in a bomb tube together with the reagent and a heavy glass rod. The air in the tube was then displaced by ether vapor or by carbon dioxide, the tube sealed, and the bulb of arsine broken by agitation. *Methods of Analysis*.—In addition to the usual methods of analysis, the following were employed: (a) In the case of halogen derivatives, it was found that halogen in direct union with arsenic was easily removed by boiling with silver nitrate and nitric acid. The excess of silver nitrate was titrated with thiocyanate, using ferric nitrate as indicator. (b) Treatment of the substance with excess of sodium dioxide separated

the arsenic from its organic groups so that it could be determined quantitatively by the ordinary methods. (c) The substance was first oxidized by chlorine or bromine water, and then treated with magnesia mixture. A precipitate in the cold indicates

inorganic arsenic; a precipitate on boiling, the  $\text{RAs}=\text{O}$  group; and

a solution which with zinc and hydrochloric acid evolves arsine

vapors, indicates the  $\text{R}_2\text{As}-$  group. (d) With hydrogen

sulphide in hydrochloric acid solution, a yellow solid precipitate indicates inorganic arsenic; a slowly forming, light-yellow gummy oil indicates  $\text{RAs}$ ; the immediate formation of a white emulsion

or of a colorless oil,  $(\text{R}_2\text{As})_2\text{S}$ , indicates the  $\text{R}_2\text{As}-$  group. (e)

The presence of arsenic, organic or inorganic, may be detected by treating with zinc and hydrochloric acid, when the vapors evolved can usually be differentiated by the odor. (f) In gaseous mixtures the volume of arsenic present was determined by treatment with silver nitrate solution. *Decomposition of Dimethylarsine by Heat*.—At  $335^\circ$  the arsine decomposed with formation of  $(\text{CH}_3\text{As})_x$  and methane. The  $(\text{CH}_3\text{As})_x$  separated on the sides of the tube as a black metallic mirror. *Oxygen and Dimethylarsine*.—Apparently the affinity of the arsines for oxygen increases with the number of alkyl groups introduced. When dimethylarsine oxidizes slowly in the air there is always formed a red solid, probably identical with the "erytharsine" of Bunsen,  $(\text{CH}_3\text{As})_4\cdot\text{As}_2\text{O}_3$ . With pure oxygen, however, the reaction proceeds with flame and the immediate formation of a black solid which is a mixture of  $(\text{CH}_3\text{As})_x$  and metallic arsenic. Altogether, seven different oxidation reactions may be carried out. The chief products of oxidation with atmospheric oxygen are usually cacodylic oxide and cacodylic acid. *Halogens and Dimethylarsine*.—In presence of organic diluents, dimethylarsine combines with halogens to compounds of the type,  $\text{R}_2\text{AsX}\cdot\text{HX}$ . When water is present, or the temperature is too high, these break down into  $\text{R}_2\text{AsX}$  and  $\text{HX}$ . In absence of organic diluents, a flame reaction occurs, with formation of polymerization and decomposition products. *Bromine and Dimethylarsine*, when brought together in a sealed tube, react energetically with production of cacodyl bromide and bromcacodyl hydrobromide,  $(\text{CH}_3)_2\text{AsBr}\cdot\text{HBr}$ . The latter forms large white tabular crystals, which are rapidly decomposed by hot water into  $(\text{CH}_3)_2\text{AsBr}$  and  $\text{HBr}$ . Some of the polymer,  $(\text{CH}_3\text{As})_x$ , is also formed in the interaction of the arsine and bromine. *Chlorine and Dimethyl-*



*arsine*.—When the arsine was treated with a slow stream of dry chlorine, an immediate flame reaction occurred, resulting in a deposition of arsenic and of a solid black polymer. With excess of chlorine, the reaction product was mostly liquid, its chief constituent being  $\text{CH}_3\text{AsCl}_2$ . *Iodine and Dimethylarsine*, in a sealed tube, reacted to produce *iodocacodyl hydriodide*,  $(\text{CH}_3)_2\text{AsI}$ . HI, which crystallized in light-yellow needles, melting at  $175^\circ$  when heated rapidly. These crystals were easily decomposed by water into  $(\text{CH}_3)_2\text{AsI}$  and HI. On the other hand, excess of aqueous iodine oxidized the dimethylarsine to  $(\text{CH}_3)_2\text{AsOOH}$ . *Alkyl Halides and Dimethylarsine*.—The secondary arsine reacts in the cold with 1 molecule of alkyl iodide to give  $\text{R}_2\text{R}'\text{As.HI}$ , while the quarternary iodide,  $\text{R}_2\text{R}'\text{AsR}'\text{I}$ , results when the secondary arsine is heated with two molecules of alkyl iodide. *Dimethyldisobutylarsonium Iodide*,  $(\text{CH}_3)_2(\text{C}_4\text{H}_9)_2\text{AsI}$ ; white crystalline solid, m. p.  $155^\circ$ , soluble in alcohol or in chloroform, insoluble in ether. *Dimethyldicetylarsonium Iodide*,  $(\text{CH}_3)_2(\text{C}_{16}\text{H}_{33})_2\text{AsI}$ ; white crystalline solid, m. p.  $53\text{--}54^\circ$ . *Dimethyldiisopropylarsonium Iodide*; pure white crystalline solid, which does not melt at  $230^\circ$ . *Dimethyldiallylarsonium Iodide*; light-yellow crystalline solid. *Dimethylallylarsine*,  $(\text{CH}_3)_2(\text{C}_3\text{H}_5)\text{As}$ , from equal molecules dimethylarsine and allyl iodide, distills at  $160^\circ$  as a clear light-yellow liquid, of strong disagreeable odor, irritating to the eyes and skin. It combines with methyl iodide to form *trimethylallylarsonium iodide*,  $(\text{CH}_3)_3(\text{C}_3\text{H}_5)\text{AsI}$ . With an ether solution of bromine it reacted violently, giving a yellow precipitate of *dimethylallylarsine dibromide*,  $(\text{CH}_3)_2(\text{C}_3\text{H}_5)\text{AsBr}_2$ . *Alkalinity of the Arsines*.—The secondary arsines possess basic properties. With sulphuric acid they form well-defined crystalline salts, which are unstable in moist air,  $2\text{R}_2\text{AsH} + \text{H}_2\text{SO}_4 \rightleftharpoons (\text{R}_2\text{AsH})_2\text{H}_2\text{SO}_4$ . With halogen acids they yield salts which are decomposed at ordinary temperatures,  $\text{R}_2\text{AsH} + \text{HX} = \text{R}_2\text{AsH.HX}$ , the latter then decomposing into  $\text{R}_2\text{AsX}$  and  $\text{H}_2$ . With chlorplatinic acid, compounds are obtained analogous to those formed with the amines  $(\text{R}_2\text{AsH})_2$ ,  $\text{H}_2\text{PtCl}_6$  and  $\text{R}_2\text{AsH.H}_2\text{PtCl}_6$ . The tertiary arsines also possess basic properties, their hydriodides being quite stable in dry air, but losing hydriodic acid in presence of water. *Dry Hydrobromic Acid and Dimethylarsine*.—These combined at  $-10^\circ$  to form  $(\text{CH}_3)_2\text{AsH.HBr}$ , but on allowing the temperature to rise gradually to  $20^\circ$  this was decomposed into  $(\text{CH}_3)_2\text{AsBr}$  and hydrogen. *Aqueous Hydrobromic Acid and Dimethylarsine* were apparently without action upon each other at ordinary temperatures, but at temperatures above  $100^\circ$  reacted to produce  $(\text{CH}_3)_2\text{AsBr}$ , and hydrogen. *Dry Hydriodic Acid and Dimethylarsine* combined at room temperature to a crystalline mass, which soon changed to the liquid  $(\text{CH}_3)_2\text{AsI}$ , with evolution of hydrogen. *Sulphuric Acid and Dimethylarsine* yielded large

prismatic crystals of *dimethylarsonium sulphate*,  $((\text{CH}_3)_2\text{AsH})_2\text{H}_2\text{SO}_4$ , together with *cacodylic acid*,  $(\text{CH}_3)_2\text{AsOOH}$ , and *cacodylic sulphide*,  $((\text{CH}_3)_2\text{As})_2\text{S}$ . *The Oxides of Nitrogen and Dimethylarsine*.—All the oxides of nitrogen, except nitrous oxide, attack dimethylarsine at ordinary temperatures, the chief product being cacodylic acid. *Nitrous Oxide and Dimethylarsine* did not react at ordinary temperature. *Nitric Oxide and Dimethylarsine* reacted to give cacodylic oxide,  $((\text{CH}_3)_2\text{As})_2\text{O}$ . *Nitrous Acid and Dimethylarsine*.—The main product of the reaction was cacodylic acid. *Nitrogen Tetroxide and Dimethylarsine* reacted with evolution of great heat and production of flame. Cacodylic acid, cacodyl, and a black polymer resulted. *Action of Nitric Acid on Dimethylarsine*.—With concentrated nitric acid a flame reaction occurred, with formation of cacodylic acid, arsenic acids, and polymerization products. *Chromic Acid and Dimethylarsine*.—Cacodyl and cacodylic acid were the products of this reaction. *Potassium Bichromate and Dimethylarsine*.—The arsine was also oxidized by the bichromate. *Molybdic Acid and Dimethylarsine* also yielded cacodylic acid. *Lead Peroxide and Dimethylarsine* gave cacodyl and cacodylic acid. *Anhydrous Ferric Chloride and Dimethylarsine*.—Cacodyl chloride was the chief product. *Cacodyl Chloride and Dimethylarsine* unite at  $100^\circ$  to form cacodyl and hydrogen chloride. *Chlorplatinic Acid and Dimethylarsine*.—Various platinum compounds were obtained, according to the conditions observed. *Auric Chloride and Dimethylarsine*; *Silver Nitrate and Dimethylarsine*.—Both of these reactions caused oxidation of the arsine, but the exact nature of the products was not discovered. *Potassium Ferricyanide and Dimethylarsine*.—Cacodyl and cacodylic acid were produced. *Mercuric Chloride and Dimethylarsine*.—Cacodyl chloride was the main product. *Sulphur and Dimethylarsine* reacted to form different sulphides according to the relative amount of sulphur used. With excess of sulphur, the solid disulphide,  $((\text{CH}_3)_2\text{As})_2\text{S}_2$ , was obtained. With smaller amounts of sulphur, the liquid sulphide,  $((\text{CH}_3)_2\text{As})_2\text{S}$ , and a few crystals of the solid  $(\text{CH}_3)_3\text{AsS}$  (m. p.  $177.5^\circ$ ) were obtained. *Sulphur Dioxide and Dimethylarsine*.—Liquid sulphur dioxide was used, and the products of the reaction were  $(\text{CH}_3)_3\text{AsS}$ ,  $\text{CH}_3\text{AsS}$ ,  $((\text{CH}_3)_2\text{As})_2\text{S}_2$ , and  $(\text{CH}_3)_2\text{AsOOH}$ . *Disulphur Dichloride and Dimethylarsine* formed cacodyl chloride and separated free sulphur. *Stannic Chloride and Dimethylarsine* gave *dimethylarsine chlorstannite*,  $(\text{CH}_3)_2\text{As}.\text{SnCl}_3$ , which sublimed in beautiful colorless needles. *Phosphorus Trichloride and Dimethylarsine* gave cacodyl chloride and an unidentified phosphorus compound. *Arsenic Trichloride and Dimethylarsine* gave cacodyl chloride and a polymeric  $(\text{CH}_3\text{As})_x$ . *Antimony Trichloride and Dimethylarsine* gave cacodyl chloride, stibine, metallic antimony, and a heavy oil. *Dibromsuccinic Acid and*



*Dimethylarsine* gave cacodyl bromide and succinic acid. *Aromatic Secondary Arsines* can be easily prepared by reducing the corresponding arsenic acids,  $R_2AsOOH$ . The *Preparation of Diphenylarsinic Acid*,  $(C_6H_5)_2AsOOH$ , was accomplished by heating to  $220^\circ$ , for thirty hours, a mixture of triphenylarsine and arsenic trichloride, pouring the mixture into water when cold, saturating with chlorine, filtering, boiling the filtrate with excess of magnesia mixture, filtering again, and acidifying the filtrate with hydrochloric acid. The diphenylarsinic acid separated first as an oil, which solidified in beautiful white needles. It was purified by a single crystallization from water. *Diphenylarsine*,  $(C_6H_5)_2AsH$ , was obtained from the latter by reduction with amalgamated zinc dust and hydrochloric acid. It was purified by distillation under diminished pressure in an atmosphere of carbon dioxide. The pure arsine is a colorless oil, which boils at  $174^\circ$  at 24 mm. or  $155^\circ$  at 37 mm. *Oxidation of Diphenylarsine* yielded diphenylarsinic acid, and phenylcacodyl oxide,  $((C_6H_5)_2As)_2O$ . *Diphenylarsine and Bromine* gave *diphenylarsine tribromide*,  $(C_6H_5)_2AsBr_3$ ; golden-yellow plates, m. p.  $129^\circ$ , which attack the skin with great avidity, and are decomposed by water with formation of a light-yellow oil, phenylcacodyl bromide. *Diphenylarsine and Iodine* gave *diphenylarsine iodide*,  $(C_6H_5)_2AsI$ . *Diisoamylarsine Compounds*.—When alkyl halides are condensed with arsenic trichloride, in presence of sodium, mono- and dialkyl arsines are formed, the relative amounts formed being determined by the ratio of alkyl halide present to arsenic trichloride. *Diisoamylarsine Chloride*,  $(C_5H_{11})_2AsCl$ .—The mixture resulting from the interaction of isoamyl chloride, arsenic trichloride and sodium, was fractioned *in vacuo* and then at ordinary pressure. *Basic Isoamylcacodyl Chloride*,  $6(C_5H_{11})_2AsCl.((C_5H_{11})_2As)_2O$ , was thus separated as a colorless liquid, boiling at  $148^\circ$  at 33 mm. or  $263^\circ$  at 750 mm., and of peculiar odor. *Isoamylcacodyl Oxide*,  $((C_5H_{11})_2As)_2O$ , was also separated, as a white soapy solid. A red body, probably similar to the "erytrarsine" of Bunsen mentioned above, was also formed in this condensation. *Diisoamylarsine Chlor-dibromide*,  $(C_5H_{11})_2AsClBr_2$ , from diisoamylarsine chloride and bromine, is a white crystalline solid, m. p.  $124-125^\circ$ . *Diisoamylarsine Sulphide*,  $((C_5H_{11})_2As)_2S$ , from the arsine chloride and hydrogen sulphide, forms beautiful white needles, m. p.  $29-30^\circ$ . *Diisoamylarsinic Acid*,  $(C_5H_{11})_2AsOOH$ , from isoamylcacodyl chloride, by a method similar to that used for the preparation of the corresponding diphenylarsinic acid, forms large flaky crystals, m. p.  $153-154^\circ$ . *Diisoamylarsine*, prepared by reducing the latter, boils at  $150^\circ$  at 90 mm., and in general resembles diphenylarsine. On oxidation, it gives *diisoamylarsinic acid* and *diisoamylcacodylic oxide*.

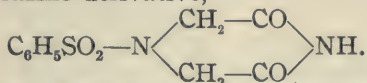
M. T. BOGERT.



**Some Derivatives of Benzenesulphonylaminoacetonitrile.**

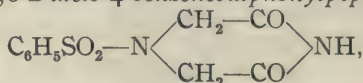
By TREAT B. JOHNSON AND ELMER V. McCOLLUM. *Am. Ch. J.* 35, 54-67.—Benzenesulphonylaminoacetonitrile,  $\text{C}_6\text{H}_5\text{SO}_2\text{NHCH}_2\text{CN}$ , by methylation and subsequent hydrolysis, was easily converted into benzenesulphonylsarcosine,  $\text{C}_6\text{H}_5\text{SO}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$ .

Attempts to condense either the latter or benzene-sulphonylglycine with pyrocatechol, and thus obtain benzenesulphone derivatives of adrenaline, failed. From benzenesulphonylaminoacetonitrile a number of analogous nitriles were prepared, several of which were also saponified to the corresponding acids. On saponifying the ethyl ester of benzenesulphonylcyanmethylacetic acid,  $\text{C}_6\text{H}_5\text{SO}_2(\text{CH}_2\text{CN})\text{CH}_2\text{COOH}$ , with dilute alkali, a rearrangement occurred with formation of the isomeric piperazine derivative,



The N-substituted benzenesulphonylaminoacetic acids are extremely stable and very difficult to hydrolyze. When benzenesulphonylsarcosine was boiled with concentrated hydrochloric acid, it gave the corresponding sulphonic acid salt,  $\text{C}_6\text{H}_5\text{SO}_2\text{OHNH}(\text{CH}_3)\text{CH}_2\text{COOH}$ . When benzenesulphonylglycine was suspended in acetyl chloride and treated with phosphorus pentachloride, benzenesulphonyl chloride was produced. **EXPERIMENTAL.**—Benzenesulphonylaminoacetonitrile,  $\text{C}_6\text{H}_5\text{SO}_2\text{NHCH}_2\text{CN}$ , from aminoacetonitrile and benzenesulphonylchloride, melts sharply at  $80^\circ$ . Knoevenagel and Lebach give its m. p. as  $76-77^\circ$ . Benzenesulphonylmethylaminoacetonitrile,  $\text{C}_6\text{H}_5\text{SO}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CN}$ , from the sodium or silver salt of the above and methyl iodide, crystallizes from water in beautiful plates, m. p.  $97^\circ$ . Benzenesulphonylmethylaminoacetic Acid,  $\text{C}_6\text{H}_5\text{SO}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$ , prepared by saponifying the nitrile, crystallizes from water in prisms, m. p.  $179^\circ$ . Its ethyl ester was obtained as an oil, boiling at  $215-216^\circ$  at 15 mm. On boiling the free acid for fifteen hours with hydrochloric acid, the benzenesulphonate of sarcosine,  $\text{C}_6\text{H}_5\text{SO}_3\text{HNH}(\text{CH}_3)\text{CH}_2\text{COOH}$ , was formed. It crystallizes from water in prisms, m. p.  $136-137^\circ$ . Benzenesulphonylethylaminoacetonitrile,  $\text{C}_6\text{H}_5\text{SO}_2\text{N}(\text{C}_2\text{H}_5)\text{CH}_2\text{CN}$ , was obtained as an oil which refused to solidify on standing and decomposed slowly when distilled. The corresponding acid crystallizes from water in colorless plates, m. p.  $116^\circ$ . Benzenesulphonyl-n-propylaminoacetonitrile was also obtained as an oil. The corresponding acid crystallizes from water in stout prisms, m. p.  $99-101^\circ$ . Benzenesulphonylcarbethoxyaminoacetonitrile,  $\text{C}_6\text{H}_5\text{SO}_2\text{N}(\text{COOC}_2\text{H}_5)\text{CH}_2\text{CN}$ , from the potassium salt of benzenesulphonylaminoacetonitrile and ethyl chlorformate, crystallizes from alcohol in needles, m. p.  $83-85^\circ$ . Heated with dilute alkali and the solution then acidified,

carbon dioxide was evolved, and benzenesulphonylaminoacetonitrile precipitated. *Benzenesulphonylbenzylaminoacetonitrile*,  $C_6H_5SO_2N(CH_2C_6H_5)CH_2CN$ , crystallizes from dilute alcohol in colorless prisms, m. p. 68–70°. The corresponding acid crystallizes in needles, m. p. 123–125°. *Benzenesulphonyl-p-nitrobenzylaminoacetonitrile* crystallizes from alcohol in prisms, m. p. 123–125°. The corresponding acid crystallizes from alcohol in hair-like needles, melting with decomposition at 210–212°. *Ethyl Benzenesulphonylcyanmethyraminoacetate*,  $C_6H_5SO_2N(CH_2CN)CH_2COOC_2H_5$ , from the sodium derivative of benzenesulphonylaminoacetonitrile and chloroacetic ester, crystallizes in needles, m. p. 68–70°. *2,6-Diketo-4-benzenesulphonylpiperazine*,



resulted when the above ester was hydrolyzed to the corresponding acid. It crystallizes in prisms, which melt at 198–199° with violent effervescence. It is soluble in concentrated sulphuric acid or in caustic alkalis. Heated with concentrated hydrochloric acid in a sealed tube at 140–150°, the hydrochloride of imidodiacetic acid,  $NH(CH_2COOH)_2$ , was obtained. *2-Ethoxy-4-benzenesulphonyl-6-ketopiperazine*, from the silver salt of the above piperazine and ethyl iodide, crystallizes from alcohol in pyramids, m. p. 130–132°. *Benzenesulphonylbenzoylaminoacetonitrile*,  $C_6H_5SO_2N(COC_6H_5)CH_2CN$ , crystallizes from alcohol in needles, m. p. 110–112°. Boiled with concentrated hydrochloric acid, it was hydrolyzed to a mixture of benzoic and benzenesulphonylaminoacetic acids. Benzenesulphonylglycine, suspended in acetyl chloride and treated with phosphorus pentachloride, lost its benzenesulphonyl group as benzenesulphonyl chloride. Attempts to condense benzenesulphonylglycine with pyrocatechol failed. *Carbethoxyaminoacetonitrile*,  $C_2H_5OOCNHCH_2CN$ , from aminoacetonitrile sulphate and ethyl chlorformate, in presence of alkali, crystallizes from petroleum ether in beautiful radiating prisms, m. p. 48–50°. M. T. BOGERT.

**Grignard Syntheses in the Furfuran Group.** BY W. J. HALE, W. D. McNALLY AND C. J. PATER. *Am. Ch. J.* **35**, 68–78.—Various tertiary alcohols and their derivatives were prepared by the action of the Grignard reagent upon the esters of pyromucic and dehydromucic acids. EXPERIMENTAL.—*Diphenyl-α-furfurylcarbinol*,  $C_4H_3O(C_6H_5)_2:COH$ , from ethyl pyromucate and phenylmagnesium bromide, crystallizes from ligroin in beautiful, colorless, rhombic prisms, m. p. 92.4° (corr.). On standing in the air, it soon melts to a gummy mass. It is very sensitive to mineral acids. Its *methyl ether* is a colorless oil, b. p. 206–207° at 26 mm.; sp. gr. at 20°, 1.1195. *Diethyl-α-furfurylcarbinol*,  $C_4H_3O(C_2H_5)_2:COH$ , from ethyl pyromucate and ethylmagnesium iodide, was

obtained as a yellow liquid of pleasant ethereal odor, which could not be purified on account of its instability. 1-Methyl-2-ethyl- $\alpha$ -furfurylethylene,  $C_4H_3OC(C_2H_5):CHCH_3$ , produced by removing a molecule of water from the above, crystallizes first in needles, which change gradually into small, colorless, rhombic prisms, m. p.  $249^\circ$  (corr.). Dibenzyl- $\alpha$ -furfurylcarbinol,  $C_4H_3O(CH_2C_6H_5)_2:COH$ , crystallizes from alcohol in beautiful, silky needles, m. p.  $82.7^\circ$  (corr.), which are much more stable than the corresponding diphenyl derivative. Its methyl ether crystallizes from low-boiling ligroin in long, colorless needles, m. p.  $61.2^\circ$  (corr.). Tetraphenyl- $\alpha, \alpha'$ -furfuryldicarbinol,  $C_4H_2O:(C(C_6H_5)_2OH)_2$ , from phenylmagnesium bromide and ethyl dehydromucate, separates from a mixture of ether and ligroin in small, colorless, rhombic crystals, m. p.  $165.5^\circ$  (corr.). This alcohol is more stable than the diphenyl- $\alpha$ -furfurylcarbinol. Its methyl ether crystallizes from alcohol in white clusters of needles, m. p.  $88.2^\circ$ . The ethyl ether crystallizes from a mixture of ether and ligroin in rhombic prisms, m. p.  $171^\circ$  (corr.), and is much more stable than the methyl ether. Tetrabenzyl- $\alpha, \alpha'$ -furfuryldicarbinol,  $C_4H_2O:(C(CH_2C_6H_5)_2OH)_2$ , was obtained as a light straw-colored viscous mass of very agreeable odor, which boiled with decomposition at  $193-195^\circ$  at 30 mm. Its sp. gr. at  $27^\circ$  was 1.126.

M. T. BOGERT.

**Note. The Preparation of Benzonitrile.** By J. BISHOP TINGLE. *Am. Ch. J.* 35, 87-88.—Various methods for the preparation of benzonitrile were compared as to relative yield, cost, and length of time required. The results are tabulated, and indicate that the dehydration of benzamide with phosphorus pentoxide constitutes the best method for the preparation of this nitrile.

M. T. BOGERT.

## BIOLOGICAL CHEMISTRY.

**The Revival of the Excised Mammalian Heart by Perfusion with Oil.** By TORALD SOLLMANN. *Am. J. Physiol.* 15, 121-122.—Perfusion of the dog's heart with oil (cotton seed and paraffin oil) under pressure starts the heart to beating rhythmically and forcibly; the contractions persist for about half an hour or longer. The two sides of the heart generally contract simultaneously and regularly. Fibrillary contraction was never noted. The left ventricle stops before the right. The perfusion of metallic mercury also shows some contractions, especially of the right heart, but the vitality seems to be lost very soon. The muscle dries very rapidly when perfused with dry mercury. The oil perfusions did not succeed in reviving hearts which had been excised from the body for some time. The contractions are not due to heat, for they are never seen when the heart is filled and



laid in warm oil without being perfused. To determine whether the effect of the oil is due to distention of the vessels, or to flow through the coronary arteries, a rabbit's heart was excised together with the lungs, and all the tissues exclusive of the aorta were included in the mass ligature. This left the coronary arteries open, but prevented all outflow from the right heart, and consequently from the coronary veins. The heart thus prepared beat when oil was admitted into the coronary artery. This experiment disposes of Magnus's explanation, the removal of the waste products. It would seem that the essential cause of the resumption of the heart beat, in the mammalian heart, is the induction of an adequate pressure in the coronary vessels.

F. P. UNDERHILL.

**Some Considerations on Proteid Diet. With Special Reference to its Content in Amido-Nitrogen, Melanoidin-Nitrogen, Diamino-Nitrogen and Mono-Amino-Nitrogen.** BY LEWELLYS F. BARKER AND B. A. COHOE. *J. Biol. Chem.* **1**, 229-239.—The determination of the above-named nitrogen values was obtained by a modification of the Hausmann method. The nitrogen values are given for veal cutlets, pork chops, sirloin, tenderloin, neck, heart, liver, thymus, chicken and fish.

F. P. UNDERHILL.

**Acetonuria Following Chloroform and Ether Anaesthesia.** BY HELEN BALDWIN. *J. Biol. Chem.* **1**, 239-251.—In a large number of cases it was observed that acetone was excreted in the urine during the first twenty-four hours following operations in which patients had been anaesthetized by chloroform or ether.

F. P. UNDERHILL.

**On a Relation between Skatol and the Dimethylamido Benzaldehyde (Para) Reaction of the Urine.** BY C. A. HERTER, *J. Biol. Chem.* **1**, 251-257.—The appearance of a skatol derivative in the urine is capable of intensifying the Ehrlich aldehyde reaction of the urine or of forming the chief basis of a reaction indistinguishable from it by ordinary tests.

F. P. UNDERHILL.

**The Quantitative Estimation of the Lecithins.** BY WALDEMAR KOCH AND HERBERT S. WOODS. *J. Biol. Chem.* **1**, 203-212.—See original paper as the methods given are too long to be given in detail here.

F. P. UNDERHILL.

**A Method for the Determination of Hydrogen Peroxide in Milk, together With Some Observations on the Preservation of Milk by This Substance.** BY SAMUEL AMBERG. *J. Biol. Chem.* **1**, 219-229.—The titanic acid method of Richardson (*J. Chem. Soc.* **43**, 1109) can be used to determine quantitatively the amount of hydrogen peroxide in milk with approximate accuracy. Boiled

milk uses up a certain amount of hydrogen peroxide. This disappearance of hydrogen peroxide is not brought about by bacterial action, and may be due to the production of reducing substances on boiling as is referred to the above. It was not decided whether this disappearance also occurs in fresh milk. While there remains some doubt as to whether hydrogen peroxide can bring about a complete sterilization of raw milk in every case, and while the amount of this substance needed for the preservation of milk during a given period of time is uncertain, its harmlessness seems to justify its trial as a milk preservative.

F. P. UNDERHILL.

**Investigations on the Reactions of Infusoria to Chemical and Osmotic Stimuli.** BY T. BRAILSFORD ROBERTSON. *J. Biol. Chem.* **1**, 185-203.—Solutions which tend to increase protoplasmic surface attract, while solutions which tend to decrease protoplasmic surfaces repel paramoecia, although the exact mechanism whereby this attraction or repulsion is carried out must be regarded as uncertain until the exact mechanism of the normal swimming movement of paramoecium has been ascertained. Paramoecia in a number of media were tested with distilled water. In most cases they were positively chemotactic to the distilled water, but in a few cases the positive chemotaxis was either absent or too slight to be recognized with certainty. The great activity developed by paramoecia on transference from N/50 solutions to distilled water is probably to be referred to the ions within the organism which have the higher velocity diffusing out of the organism more quickly than the other ions, and thus causing an initial rapid decrease of the potential differences at the protoplasmic surfaces, followed by a rapid increase in the opposite sense, and this again by a rapid decrease until equilibrium is reached. Certain exceptional results obtained on chemotaxis are probably due to the interference of osmotactic effects in producing the reaction. The reaction of paramoecia to chemotaxis and osmotaxis in solutions of non-electrolytes was also tested, and it was found that they were positive in a greater or less degree.

F. P. UNDERHILL.

**The Oxidation of Amido-Acids with the Production of Substances of Biological Importance.** BY H. D. DAKIN. *J. Biol. Chem.* **1**, 171-177.—By the oxidation of alanine, acetic acid was recovered. After oxidizing glycocoll the presence of formic acid could be demonstrated together with a large quantity of glyoxylic acid and ammonia. Leucine yielded carbon dioxide, isovaleric aldehyde, and a volatile substance giving the iodoform reaction.

F. P. UNDERHILL.

**On the Solubility of Uric Acid in Blood Serum.** BY ALONZO ENGLEBERT TAYLOR. *J. Biol. Chem.* **1**, 177-184.—It is shown

that uric acid is much more soluble in the blood than has been commonly assumed, and that when in the blood it does not exist as free uric acid but is held there in the form of some complex which requires boiling with an acid to break up in such a manner that the uric acid added may be recovered.

F. P. UNDERHILL.

**On Sulphate and Sulphur Determinations.** BY OTTO FOLIN *J. Biol. Chem.* **1**, 131-160.—Folin shows that the ordinary methods for the determination of sulphates and sulphur, especially in urine, give incorrect results, and methods are given by which these errors may be eliminated.

F. P. UNDERHILL.

**The Concentration of Antitoxin for Therapeutic Use.** BY ROBERT B. GIBSON. *J. Biol. Chem.* **1**, 161-171.—The method employed follows: The serum is precipitated by the gradual addition with stirring of an equal volume of saturated magnesium sulphate. The precipitates are dissolved in water, and the resulting solution reprecipitated with ammonium sulphate equal to the volume of the water added. The precipitated globulins are collected on filter-papers and treated with twice the original serum volume of saturated sodium chloride. After standing, the sodium chloride extracts are completely precipitated either by the addition of about half this volume of saturated ammonium sulphate solution, or better, by the addition of about 0.25 per cent. acetic acid. The final precipitate is filtered off and dialyzed in running water. After filtering the dialyzed solution, it is roughly sterilized through a Berkefeld after a quarter to a half per cent. of sodium chloride has been added. The antitoxin globulin solution is again sterilized by a filtration through a second Berkefeld and a preservative added.

F. P. UNDERHILL.

**Inhibitory and Anesthetic Properties of Magnesium Salts.** BY S. J. MELTZER. *Med. Record*, 1905, December, 16.—It is shown that intravenous injections of magnesium salts in very small doses inhibit the respiration and cause paralysis of the entire body. Local applications to nerve trunks block the conductivity and abolish the excitability of the nerves. Subcutaneous injection produces deep narcosis with complete muscular relaxation, and subarachnoidal injection produces nearly immediate anesthesia and paralysis of the posterior extremities. All these inhibitory and anesthetic phenomena may completely disappear again. Intravenous injections of magnesium salts stop almost immediately all intestinal peristalsis, and a severe tetanus and opisthotonus produced in monkeys by tetanus toxin can be completely relieved for many hours by subarachnoidal injection of magnesium sulphate. A series of



cases is also given in which it is shown that magnesium salts may be successfully used for nearly all operative cases.

F. P. UNDERHILL.

**A Method for the Quantitative Estimation of Indol.** By C. A. HERTER AND M. LOUISE FOSTER. *J. Biol. Chem.* **1**, 257-261.—A colorimetric estimation based upon the reaction taking place between indol and sodium  $\beta$ -naphthoquinonemonosulphonate.

F. P. UNDERHILL.

**The Cutaneous Excretion of Nitrogenous Material.** By FRANCIS GANO BENEDICT. *J. Biol. Chem.* **1**, 263-271.—As a result of the data obtained it is concluded that even when the subject had no muscular exercise there was a measurable quantity of nitrogenous material excreted through the skin each day, the average quantity being about 0.071 gram per day. Hard muscular work increases the quantity of nitrogenous material excreted by the skin to an average of 0.22 gram nitrogen per day.

F. P. UNDERHILL.

**The Action of Saline Solutions on the Vitality of Blood Vessels.** By R. A. HATCHER. *Am. J. Physiol.* **15**, 144-148.—Dogs' kidneys show little or no reaction to adrenaline after about three hours' perfusion with normal saline at about 25°, and if the perfusion be continued for ten to twenty-four hours and blood be then substituted for the normal saline perfusion, only a slight reduction of haemoglobin occurs. Kidneys perfused with Ringer's solution show the adrenaline reaction for a somewhat longer time than those in which normal saline is used, and the reduction of haemoglobin after three to six hours is somewhat greater than is the case after normal saline. When Locke's solution is perfused the kidneys react to adrenaline after twenty to twenty-seven hours, and after twenty-four hours the reduction of haemoglobin is usually distinctly greater than after normal saline for the same period.

F. P. UNDERHILL.

**Further Evidence of the Similarity between Catalysis and Enzyme Action.** By C. HUGH NEILSON. *Am. J. Physiol.* **15**, 148-153.—By experiments with salicin and platinum black, salicin and manganese dioxide, amygdalin and platinum black in which the sugar formed was estimated, it is concluded that enzymatic action is a catalysis and perhaps nothing more.

F. P. UNDERHILL.

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## PHARMACEUTICAL CHEMISTRY.

**Changes in the Pharmacopoeia of the United States of America.** By REID HUNT AND MURRAY GALT MOTTER. *Bull. No. 23, Hygienic Laboratory, Public Health and Marine-Hospital Service.*—The Bulletin contains 122 pages. In the introduction they

state that "The U. S. P. is the official standard of the U. S. Public Health and Marine-Hospital Service. Drugs purchased for its hospitals and relief stations must conform to the Pharmacopoeial requirements." They then consider the Terminology, Changes in Strength of Preparations, Additions, Assay Methods, Doses and the Relation of Physicians to the Pharmacopoeia. Then follows a detailed description of the various substances added to the Pharmacopoeia, giving properties, uses, and in the case of synthetics, the chemistry and related compounds. Under *Acetone* we find that when a phenyl radical takes the place of one of the methyl groups the resulting compound is phenylmethylketone ( $C_6H_5COCH_3$ ), known as acetophenone. It is used as a hypnotic under the name of hypnone. Malarine is a condensation product of acetophenone and paraphenetidine.

Under *Acetphenetidin* they state that it is a representative of a large number of similar compounds which are derived from para-

aminophenol,  $C_6H_4 \begin{matrix} \text{OH (1)} \\ \text{NH}_2 \text{ (4)} \end{matrix}$ , by replacing the hydrogen of the

hydroxyl group, and one or both of the hydrogen atoms of the amino group by alkyl or acid radicals. By the introduction of the lactyl group  $COCH(OH)CH_3$  into paraphenetidine instead of the acetyl

group  $CH_3CO$ , *lactophenin* is formed,  $C_6H_4 \begin{matrix} OC_2H_5 \\ NHCOCH(OH)CH_3 \end{matrix}$ .

Similar compounds having practically the same physiological action are: *Sedatin*, *apolsin*, *citrophen*, *kryofin*, *malakin*, *salophen*, *saliphen*, *phenocoll*, *salocoll*, etc.

Under *Ethyl Carbamate* (urethane) we find as closely allied substan-

ces, *hedonal* (methylpropylcarbinolurethane =  $CO \begin{matrix} NH_2 \\ O-CH \begin{matrix} CH_3 \\ C_3H_7 \end{matrix} \end{matrix}$ ),

*euphorine* or phenylurethane,  $CO(NHC_6H_5)OC_2H_5$ , *neurodin*, *thermodin* (*phenacetin-urethane*), and the *veronal* of Emil Fischer and

von Mering, which is diethylmalonurea,  $\begin{matrix} C_2H_5 \\ C_2H_5 \end{matrix} \begin{matrix} \diagup \\ \diagdown \end{matrix} C \begin{matrix} \diagdown \\ \diagup \end{matrix} \begin{matrix} CO-NH \\ CO-NH \end{matrix} \begin{matrix} \diagup \\ \diagdown \end{matrix} CO$ .

*Ethyl Chloride* is also known as *chylene* or *kelene*. *Anaesthol* (Speier) for local anaesthesia, is a mixture of ethyl chloride and methyl chloride. *Anaesthol* for general anaesthesia is a mixture of ethyl chloride 17 parts, chloroform 36 parts, ether 48 parts, by weight. *Somnoform* is a mixture of ethyl chloride 60 parts, methyl chloride 35 parts, and ethyl bromide 5 parts, by weight. *Anestyl* and *coryl* are mixtures of ethyl and methyl chlorides.

*Antipyrine* is chemically phenyldimethylisopyrazolone. It has appeared under various names as, *anodynin*, *metozoin*, *oxydimethylchinizin*, *parodyn*, *phenazon*, *phenylon*, *pyrazolin*, and *sedatin*.

"Allied compounds. Antipyrine unites with resorcin to form *resopyrin*, with salicylic acid to form *salipyrin*, with chloral hydrate to form *hypnal* and other compounds. *Pyramidon* is a dimethylamino substitution product of antipyrine. *Ferripyryn* is a compound of ferric chloride and antipyrine."

*Benzosulphinide* (Saccharin). "Official as *Saccharinum* in the Austrian and Swiss Pharmacopoeias, as *Glusidum* in the British Pharmacopoeia, and as *acide anhydroorthosulfamide-benzoique* in the French. It is variously known as *glucosimide*, *saccharol*, *saccharinol*, *saccharinose*, *agucarine*, etc."

Under *Cocaine* they give preparations that have recently been introduced as substitutes for cocaine as local anesthetics. *Beta-eucaine*, the hydrochloride of benzoylvinyldiacetonealkamine, *holocaine*, which may be regarded as a derivative of acetophenetidine, *tropococaine*, (benzoylopseudotropein), *nirvanin*, *anaesthin* (paraaminobenzoic acid ester), *orthoform* and *stavoin*.

*Codeine* is methylmorphine ( $C_{17}H_{18}(CH_3)NO_3$ ). They give similar morphine derivatives *dionine*, ethylmorphine hydrochloride ( $C_{17}H_{17}NO(OH)OC_2H_5HCl + H_2O$ ). *Peronine*, benzylmorphine hydrochloride ( $C_{17}H_{18}NO_3(C_6H_5CH_2)HCl$ ). *Heroine*, diacetylmorphine ( $C_{17}H_{17}NO(C_2H_3O_2)_2$ ).

*Hexamethylenamine*, chemically hexamethylenetetramine,  $(CH_2)_6N_4$ . It is also known as *aminoform*, *ammonioformaldehyde*, *cystamine*, *cystogen*, *formin*, *uritone*, and *urotropin*.

In the introduction they state that hexamethylenamine is sold under at least seven different names, but "By demanding the U. S. P. article the physician is not only assured a product of uniform high quality, but he aids in reducing the multiplicity of names which is so often a source of confusion."

A. B. STEVENS.

## INDUSTRIAL CHEMISTRY.

**Notes on the Standardization of Fuses.** BY ALFRED SCHWARTZ. *Am. Gas Light J.* 84, 1, pp. 12-13, January 1, 1906, from *Electrical Review*, London.—Engineers as a rule regard the fuse as a very unreliable piece of apparatus and think that it will soon be replaced by the circuit-breaker. The reason the fuse is so unreliable is that no effort has been made to devise a standard fuse. The author points out the particulars in which standardization is advisable. First, the length of break should be standardized for various circuit voltages and for various carrying capacities. An increase in the length of break with increased carrying capacity is suggested as a means of reducing the chances of the persistence of the arc and consequent fire risk. Second, for short-circuit service the fuse should be so standardized that the consumer need not be put



to the expense of fusing to withstand station conditions. Third, the material of the fuse should be such that it can readily be obtained pure. Under normal conditions it should be resistant to oxidation and the oxide film, if formed, should not be of sufficient strength to hold up the molten metal. On disruption the metal should not arc, form heavy vapors, nor be widely scattered. Furthermore, the difference of potential at contact between fuse metal and terminals and the coefficient of expansion of the fuse metal and the terminal metal, as well as the ease with which the metal may be worked up into wire or strips, must be considered in the choice of material. Fourth, the fuse should be stamped with its normal carrying capacity, its overload capacity and the time within which it blows when started cold and with a specified overload. Besides standardizing for the normal fusing current, the conditions for fusion on short-circuits, the tendency to arc on fusion with currents in excess of the normal fusion current and the temperature rise for enclosed fuse covers must be tested and the conditions standardized. Finally, the form of contact between the fuse and the terminal must be considered in order to insure good contact at all times and under all conditions. The author believes that inasmuch as the safety of an electric system depends so much on the fuses it is worth while to carefully standardize the fuse so that it may be no longer considered "a legacy from the dark ages" but a dependable unit in the engineer's electrical equipment.

G. R. WHITE.

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## AGRICULTURAL CHEMISTRY.

**The Mineral Constituents of the Soil Solutions.** BY FRANK K. CAMERON AND JAMES M. BELL. *Bull.* 30, *Bur. of Soils, U. S. Dept. of Agr.* Washington, D. C.—In general, all soils contain, in addition to organic matter, gases and their solutions, all of the common rock-forming minerals and their decomposition products. These minerals are soluble in water and, when made up of alkalis, or alkaline earths, in combination with silicic, aluminosilicic, or ferro-silicic acids, their solutions give an alkaline reaction. This is due to the hydrolysis of these strongly basic minerals. In this way, water gives an alkaline solution with sodium and calcium carbonates. "Kaolinization" may be considered as the result of the hydrolysis of orthoclase; thus:  $\text{KAlSi}_3\text{O}_8 + \text{HOH} = \text{KOH} + \text{HAlSi}_3\text{O}_8$ , the latter product losing silica,  $\text{HAlSi}_3\text{O}_8 - 2\text{SiO}_2 = \text{HAlSiO}_4$ , and giving kaolin.

In the action of water upon minerals, we have, then, not a true solubility effect, but, rather, a process of hydrolyzation. The removal of the hydrolyzed products as fast as formed assures the continuous solubility of the mineral. The rate of solution is very slow, but, with no disturbing factors, an equilibrium

would be reached. However, "it seems improbable that any given volume of ground water would ever remain sufficiently long in contact with the soil grains to come into equilibrium with them." The solubility of the minerals is influenced by temperature, pressure, the presence of carbon dioxide, by more soluble inorganic salts, and by vital agencies. The authors doubt the presence of organic acids in the humus of the soil, the reddening of litmus paper by humus being "probably a purely absorptive phenomenon." Connected with solution and hydrolysis is the phenomenon of absorption. Not to be confused with this, is the ability of some solids to absorb some materials from solution and leave others unaltered. Porous charcoal and other solids absorb gases, sand will absorb potash, and its power to purify drinking-water in this way is well-known. Paper exercises a selective power when absorbing solutions, as may be shown by dipping a strip of blotting-paper in solutions of various dyes, when the water will rise higher than the solution of the dye. It is shown that the presence of sodium eosine decreases the rate at which water travels through paper while potassium chloride "decreases markedly the rate at which the dye travels through the paper." Carbon, silica, kaolin, and other materials furnishing a large surface will exercise a selective absorption of solutes, and so affect not only the concentration, but also the basicity or acidity of the solution. The alkalinity of powdered orthoclase may not be evident in the presence of the suspended matter because this adsorbs the phenolphthalein. Soils exhibit absorption phenomena. A solution of methylene blue poured through soils will always run clear at first. The amount absorbed varies with different soils but "it would seem that the absorptive power.....exhibited in a number of soils, was in about the same order as their known crop-producing values." Soil acidity, as usually measured, may be rather an indication of the absorptive power of the soil. It is shown that "soils are good absorbers, that those substances which are prominent as fertilizer constituents are markedly absorbed by soils, and that the reactions taking place among the substances may be and probably are much modified when they take place in the presence of the absorbing surface." In conclusion, among other things, the authors state that "the concentration of the soil solution, with respect to the principal mineral plant food nutrients, is sufficient for the growth and development of crops. And, further, the magnitude of the concentration is the same for practically all soils." The surfaces in contact with these solutions modify their reactions and "the development of a modern soil chemistry is dependent upon a study of the chemical changes induced by surface contact, and upon a study of the properties of the water-soluble organic as well as inorganic matter of the soil."

J. H. PERRY.

**Manurial Requirements of the Portsmouth Sandy Loam of the Darlington Area, South Carolina.** BY F. D. GARDNER AND F. E. BONSTEEL. *Circular No. 17, Bur. of Soils, U. S. Dept. of Agr.*—After giving the history and description of a particular area of this type of soil, the extent to which various manurial treatments affect it is shown. The results were obtained by means of the twenty-day wire-basket method. The use of a complete fertilizer, made up of 200 pounds of each of the following materials—sodium nitrate, potassium sulphate, and acid phosphate—and costing about \$10.00 per acre, gave a 30 per cent. increase in yield; 1,000 pounds of lime costing about \$1.50 added to this gave 107 per cent. increase. The authors state that "the financial side of this is too obvious to need discussion." Assuming that the yield without treatment is 20 bushels per acre, the value of 107 per cent. increase is \$14.98 when wheat is worth \$0.70 per bushel. This will give \$3.48 to pay for the labor of applying \$11.50 worth of treatment and harvesting and marketing the extra 21.4 bushels. But if the untreated yield is only 10 bushels per acre, the value of 107 per cent. increase is only \$7.49. Accordingly, the actual yield, as well as the price per bushel, must be considered in determining the profitableness of treatment. It is further shown that lime alone gave a 47 per cent. increase; this is worth, in the case of a 20-bushel yield, \$6.58 and \$3.29 for a 10-bushel yield, while it cost but \$1.50. Though the lime alone gives the smaller yield, yet it was here the more profitable. Large yields are not necessarily economical.

J. H. PETTIT.

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## PATENTS.

AUGUST 1, 1905.

795,825. Frederick G. Dockenwadel, Coshocton, Ohio. Assignor one-half to Harry M. Grant, New York, N. Y. **Blasting compound.** Sulphur 1, paper pulp 3, and sodium and potassium nitrates mixed 4 parts, the whole bound together with glucose and glue, and granulated.

795,860. Gustav H. Roeder, Philadelphia, Pa., by Christiana K. Roeder. Administratrix and assignor to Albert Tilt and Ernest F. Greeff, New York, N. Y., and Charles C. Rossere, Yonkers, N. Y. **Extracting caoutchouc.** Nettle stalks are decorticated, the thin sap squeezed out, then soaked in water and treated with turpentine or alkali to dissolve out the rubber which is afterwards separated by a centrifuge.

795,869. Alfred Thauss, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Thiazole-sulphonic acid.** Metaaminobenzenylthio-2-5-aminonaphthol-7-sulphonic acid; its sodium salt is a grayish powder soluble in



water, the free acid a yellow-brown powder scarcely soluble in water, combining with diazobenzene to make a red dye, and adapted for diazotizing and further combination with dye components.

795,886. Anson G. Betts, Troy, N. Y. **Making aluminum.** A mixture of iron ore and clay is reduced in an electric furnace to ferro-silicon containing aluminum, the alloy being made an anode beneath the electrolyte, and the aluminum obtained by electrolysis.

795,887. As above for **electrolytic refining of silver.** The silver alloy is made an anode in an electrolyte of methylsulphuric acid and a little gelatin.

795,940. James C. Smith, Lovington, Ill. **Making Explosives.** Granulated sugar 20 and saltpeter 10 are boiled in just enough water for solution, potassium chlorate 35 parts are added, then 35 parts of stone coal in powder, the whole dried and pulverized.

796,097. Oscar Wiederhold, Bloomfield, N. J. **Bunsen burner.** The lower part of the tube is made slightly conical, the upper part straight of smaller diameter and closed with a conical plug at top, the sides of the top being perforated, and the top portion serving as a mixing chamber.

796,164. Henry C. Todd and Charles Mayr, Chicago, Ill. **Asbestos compound.** Aluminum silicate and sodium silicate 2 to 1, and 10 parts water are mixed and an asbestos fabric saturated with the liquid, dried and heated to about 800° F.

796,253. Henderson Ryan, Seattle, Wash. **Treating artificial stone.** Dilute phosphoric acid is applied to the surface of the stone and then washed off. A wash of sugar of lead may precede the phosphoric acid.

796,282. Ralph Baggaley, Pittsburg, Pa. **Converting matte.** A lining of unpacked silicious material is distributed over the working area of the interior of the converter, it is sintered in place, matte introduced and air blown through.

796,338. Hudson Maxim, New York, N. Y. **Pulverizing metals.** Melted metal is sprayed into a heated inert gas, and the sprayed metal passed into contact with a cooled gas.

796,339-40. Wm. T. Mercier, Belfast, Ireland. Assignor to Ozonized Oxygen Co., Manchester, England. **Bleaching flour, etc.** The flour, etc., is treated by a mixture of ozone and chlorine, and in an apparatus consisting of a blower, an ozonizer, an electrolytic tank of iron with partial partitions, and suitable connecting pipes.

796,393. Oscar Bally, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Ger-

many. **Yellow-green anthracene dye.** A compound containing a benzanthrone group is nitrated and then reduced. A dark green powder, soluble in concentrated sulphuric acid and in boiling nitrobenzene, insoluble in water, dilute acid and alkalies, but giving a green-blue hydrosulphite vat.

AUGUST 8, 1905.

796,443. Theodore Muchall, Biebrich, Germany. Assignor to Kalle and Co., same place. **Red-violet sulphur dye.** Benzene-azo- $\alpha$ -naphthylamine is boiled with *p*-aminophenol in aqueous solution, and the resulting polyhydroxyrosinduline melted with alkaline polysulphides. Soluble in sodium sulphide solution bluish red, in concentrated sulphuric acid blue, dyeing from sodium sulphide solution red-violet on cotton.

796,459. Bert Seaboldt, Salt Lake City, Utah. **Siloxicon compounds.** One hundred parts of siloxicon are heated with fire-clay 7, bran or chaff 1 and sodium chloride 2 parts, and not to exceed 30 parts of water so as to reduce said compounds, and the temperature is then raised and the liberated constituents act as a flux on the siloxicon to make it cohere.

796,496. Joseph H. Campbell, Brooklyn, N. Y. **Peptonized milk.** Assigned to National Nutrient Co., Jersey City, N. J. A peptonizing agent is added to fluid milk which is allowed to partially peptonize, and then made substantially dry so as to arrest the peptonizing action, leaving a reserve that may be called into action when the dried milk is moistened.

796,514. Julius Hoerlin, Uerdingen-on-Rhine, Germany. Assignor to Chemische Fabriken, same place. **Yellow sulphur dye.** Nitro- $\alpha$ -methylbenzimidazole is melted with benzidine and sulphur at a high temperature.

796,604. Edgar F. Reed, Dorchester, Mass. Assignor to Liquid Wall Paper Co., Dorchester, Mass. **Wall coating** Glycerol and alum 1 part each, Irish moss 8, flour 32 and water. 130 parts.

796,670. Donald Macdonald, Louisville, Ky. **Making gas.** The retort contains a body of coke and a superposed body of coal, the coke is made incandescent by a blast which does not go through the coal, which nevertheless gives off some gas, steam is passed through the coke to make water gas, which is passed through the body of coal and then through a superheater, and afterwards mixed with the first gas from the coal, and when the coke is cooled, steam is passed downward through the coke and all the gases are mixed together.

796,683. Carl Sundstrom, Detroit, Mich. **Paper filler, etc.** Assigned to Solvay Process Co., N. Y. The mother-liquor from ammonia soda is treated with calcium chloride making ammonium

chloride and calcium carbonate, the latter being filtered and washed.

796,713. Hans Foersterling and Herbert Philip, Perth Amboy, N. J. Assignors to Roessler and Hasslacher Chemical Co., New York, N. Y. **Urea.** Sulphuric acid is added to disodium cyanamide at a suitable temperature to set the cyanamide free, then more sulphuric acid is added to make urea.

796,715. Victor Fussganger, Höchst-on-Main, Germany. Assignor to Meister, Lucius und Brüning, same place. **Dyeing violet to black.** Paraminodiphenylamine is oxidized with amines or phenols on the fiber, which is dried, developed and steamed.

796,754. John R. Parks, Spokane, Wash. **Treating ores.** Powdered ore adapted for cyanide treatment is made into a slime with water, cyanide of potassium and an electrolyte added, the whole placed in an electrolyzing cell in contact with mercury on a metallic surface, and the current passed, and also an air blast.

796,775. Gustave Tuschel, Odessa, Russia. **Priming wood.** The article is twice sized with glue and ground limestone, and rubbed smooth, and a varnish applied of red and yellow accroide resin, 45 each boiled in water, Manila copal 70, methylated spirit 1200, and sulphuric ether 10 parts.

796,849. John S. MacArthur, Glasgow, Scotland. Obtaining **antimony.** The ore is first treated with an alkali solution of less than 4 per cent. of caustic soda and at a temperature over 50° C., the antimony being precipitated by carbon dioxide, which at the same time forms an alkaline carbonate for re-use, after it is causticized.

AUGUST 15, 1905.

797,024. Fin Sparre, Wilmington, Del. Assignor to E. I. DuPont de Nemours Powder Co., same place. **Phenol esters.** Caustic alkalies and phenol are dissolved in alcohol, and the halogenized hydrocarbon that corresponds to the desired alcohol group added. Methyl chloride may be used.

797,112. Alexandre de Hemptinne, Ghent, Belgium. Converting oleic acid to **stearic acid.** The oleic acid is acted on by electric effluvia in an atmosphere of hydrogen.

797,150. Thomas Rouse and Herrmann Corn, London, England. **Ore briquets.** Powdered iron ore is mixed with a solution of alum and water glass, molded and furnaced.

797,323. Peter Roemer, Bernberg, Germany. **Chromates.** Alkaline carbonates are added to chrome iron ore in quantity insufficient to decompose it, the mixture heated by an oxidizing flame, cooled, lixiviated, and the residue heated with an additional quantity of an alkaline carbonate.



797,373. Robert N. Riddle, Uwchland, Pa. Assignor to the Warner Chemical Co., Carteret, N. J. Solvent for **nitrocarbohydrates**. Nitrocellulose is dissolved in phenyl acetate.

797,391. George B. Williamson, Gramercy, La. Assignor to Blanche Augrain, New Orleans, La. **Clarifier for cane juice**. Sulphuric acid 3 parts, bone-black dust and water 4 parts each.

797,441. Thilo Kroeber and Carl Jagerspacher, Basel, Switzerland. Assignors to Firmac Society of Chemical Industry, same place. **Azo dye**. The basic alkali salts of 1-2-aminonaphthol-sulphonic acid are treated with acetic anhydride in aqueous solution to acetylate the hydroxyl group, they are then diazotized, and the resulting 1-amino-2-acetoxynaphthalenesulphonic acids diazotized and combined with an azo color component. Dyes unmordanted wool violet or bordeaux, turning black on chroming.

797,458. Friedrich Rompler, Vienna, Austria-Hungary. Assignor to Protalbin Werke, Aktiengesellschaft, Dresden, Germany. **Photographic emulsion**. Casein is partly converted into alkali casein, and precipitated by magnesium sulphate, the precipitate is separated and washed, dissolved in and sensitized with halogen silver salts.

797,481. Seymour S. White and John H. Strong, Wadena, Minn. **Renovating butter**. The butter is heated to 85° F., washed with fresh water or brine, worked at the same temperature with buttermilk, cream or ripened milk, salted and colored, worked in, and 5 per cent. of water added at 40° F.

797,493. Norbert Ceipek, Vienna, Austria-Hungary. **Explosive**. Ammonium nitrate 85 and aniline nitrate 15 parts are mixed and 85 parts of the mixture combined with 15 of aluminum.

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797,553. Walter P. Butler, Minneapolis, Minn. **Artificial stone**. Sand is mixed with a suitable quantity of powdered talc, or soap stone, or any other stone having smooth, soapy, slippery properties to form the molds in which the stone is cast.

797,588. George M. Lawton, Worcester, Mass. **Mordant**. Produced by mixing water, sulphate of iron, pyrolignite of iron, and nitrate of iron in any desired proportions for a logwood mordant.

797,624. Jacob Staudt, Bonn, Germany. **Artificial stone**. Quartz meal and quartz sand are mixed with from 5 to 20 per cent. of linseed oil as a binder, whereby a loose moist powder is formed, which is then stiffened by heat and afterward baked for twelve to twenty-four hours at 200° C.

797,668. Joanny A. Dejeu, Charenton, France. **Etching metal**. A greasy ink transfer is made on metal, washed with acidulated water to remove gum, etc., the plate is coated with

tin in the exposed parts by electrolysis while warm, the ink removed by benzine, the plate etched with cupropotassium cyanide which does not attack tin but only the metal of the plate; chromic acid may also be employed.

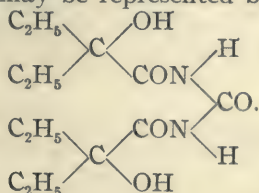
797,683. William A. Hall, Bellows Falls, Vt. **Paint composition.** Whiting or talc, 200 and about 25 parts of a vegetable oil as corn-oil and 10 parts alkalized casein.

797,702. Charles E. Nutting, Hopedale, Mass. **Water-proofing bobbins.** They are first coated with thin shellac varnish, afterwards with thick shellac.

797,731. Martin Herzberg, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Black azo dye.** The diazo compound of mononitroacetyl-*p*-phenylenediamine is combined with 1-ethoxy-8-naphthol-3,6-disulphonic acid, and then the acetyl group is split off by saponification. Its sodium salt is a dark powder soluble in water with a violet color; dissolves in concentrated sulphuric acid 66° Baumé with a greenish blue color which is changed to red on the addition of ice; dyes unmordanted wool black shades; upon reduction with stannous chloride and hydrochloric acid yields triaminobenzene and 1-hydroxy-2-amino-8-ethoxynaphthalene-3,6-disulphonic acid.

797,732. Same. **Black azo dye.** Diazotized mononitroacetyl-*p*-phenylenediamine is combined with 1-ethylamino-8-naphthol-3,6-disulphonic acid and the acetyl group split off by saponification. Its sodium salt is a dark powder soluble in water with a blue color, being dissolved in sulphuric acid 66° Baumé with a red color; dyes unmordanted wool black shades; upon reduction with stannous chloride and hydrochloric acid, yields triaminobenzene and 1-hydroxy-2-amino-8-ethylaminonaphthalene-3,6-disulphonic acid.

797,792. Erik C. Clemmensen and Arnold H. C. Heitmann, Detroit, Mich. Assignors to Parke, Davis & Co., Detroit, Mich. **Alkyloxyacetylurea.** A colorless, oily liquid, with slight ethereal odor and acid taste, sp. gr. 1.1107, at 36 mm. pressure, boils at 186° C., is soluble in about 20 parts of water, but readily soluble in water containing alkali, forming soluble crystalline salts; very soluble in organic solvents such as alcohol, ether, chloroform, acetone, benzene and glycerol. It has hypnotic action. Its formula may be represented by



It is produced by condensing an alkylhydroxyacetic ester and a urea with an alkali alcoholate.

797,923. Charles Shipp, Barnsbury, London, England. Assignor to Benjamin Franklin Nichols, London, England. **Covering for drawing rolls.** Consists of boiled and oxidized linseed oil, and boiled Chinese wood oil heated with karuki gum, and resin, and ground up with cork.

797,961-962. Karl Kaiser, Berlin, Germany. **Making ammonia.** Metallic calcium and metallic magnesium are heated alternately in nitrogen and hydrogen, or their nitrides are alternately subjected to the action of hydrogen and nitrogen.

797,982. Horatio W. Southworth, London, England. **Treating raw hide.** First soak the hides in a solution of sulphate of iron, then in aluminum acetate and glycerol, partly drying, coating with castor oil and alcohol, then with oil, and finally with a solution of India rubber.

798,006. Phares Bell, Cleveland, Ohio. **Slating composition.** Consists of wood alcohol 30, grain alcohol 7, orange shellac 5, lamp-black 4, chrome-green 7, ultramarine blue 2, whiting  $\frac{1}{2}$  and pumice stone  $1\frac{1}{2}$  parts.

798,013. Alphonso M. Clover, Ann Arbor, Mich. **Antiseptic.** A compound derived from succinic peroxide acid and a basic substance. In aqueous solution it is colorless and odorless; when acidified with a mineral acid it yields succinic peroxide acid; it hydrolyzes upon standing with the formation of the salts of succinic acid and succinic mono-peracid and upon long standing yields the salt of succinic acid and hydrogen peroxide.

798,027. Charles A. Ernst, Lansdowne, Pa. **Filaments from viscose.** The filaments are set by immersing in a bath containing sodium bicarbonate and ammonium bicarbonate in conjunction with ammonium sulphate.

AUGUST 29, 1905.

798,070. Francis J. Oakes, New York, N. Y. **Treating hides.** Hides are soaked in a bath containing putrefying albuminous matter and sulphur to the amount each of about 5 per cent of the weight of the hides.

798,077. Paul Seidel, Ludwigshafen-on-Rhine, Germany. Assignor to the Badische Anilin und Soda Fabrik, same place. **Making indolic bodies.** A phenylglycine body is heated with a caustic alkaline substance, the melt is dissolved and treated with an oxidizing agent. The precipitated indigo is removed and the indolic body isolated.

798,098. Fritz C. Gunther, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Yellowish azo dye** is obtained by combining diazotized sulphanilic acid with 2,6-diamino-1-chlorbenzene-4-sulphonic acid.



It is soluble in water, and gives a yellow solution in dilute sodium carbonate solution; a reddish yellow solution in dilute hydrochloric acid, and a brilliant red solution in concentrated sulphuric acid; produces yellow shades when dyed on wool; when reduced with tin and hydrochloric acid it yields sulphanilic acid and 2,3,6-triamino-1-chlorbenzene-4-sulphonic- acid.

798,103. Rudolph Hutzler, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Making alkaline metal oxide.** An alkali metal is heated with its nitroxy salt with the exclusion of air.

798,104. Max H. Isler, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Anthracene compound.** By condensing a naphth-anthraquinone body with glycerol, a compound is obtained containing a benzanthrone group, soluble in concentrated sulphuric acid, and on melting with caustic alkali yields coloring-matters which, from an alkaline hydrosulphite vat, dye vegetable fibers. They may be called benznaphanthrones.

798,176. Carleton Ellis, New York, N. Y. Assignor to Eldred Process Co., same place. **Generating gas.** The gases of combustion are withdrawn from a cement kiln, the dust separated and air or oxygen added so as to reduce the carbon dioxide to monoxide on passing the mixture through a bed of non-flaming fuel, thereby making a fuel gas.

798,181. Arthur E. Hobson, Meriden, Conn. **Alloy.** Consists of tin 109, copper 3, antimony 9, and manganese  $\frac{1}{5}$  part by weight.

798,205. Heinrich H. Niedenfuhr, Halensee, Germany. **Making nitric acid.** Any suitable compound of nitric acid is treated with reagents capable of evolving nitric acid obtaining a concentrated mixture of the higher and lower oxides of nitrogen, the higher oxides being condensed to nitric acid, the process taking place out of contact with the generating substance and at a comparatively high temperature. The lower oxides are removed from the condensed nitric acid, subjected to pressure and condensation and oxidized by treatment with air.

798,208. Camille Petri, Buchsweiler, Germany. **Making sodium ferrocyanide.** A suitable quantity of sodium chloride is treated with a solution of calcium ferrocyanide.

798,216. Maximilian Scharff and Franz Slama, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Removing arsenic from gases.** Sulphurous gases containing arsenic are passed at a temperature over  $200^{\circ}$  but less than red heat through a metallic oxide, as ferric oxide.

798,239. Gregor Walzel, Newark, N. J. **Apparatus for making**

**carbon dioxide.** A double shaft reduction furnace, a regenerator, means for alternate connection of either shaft with the regenerator, a hot-blast device, condenser and main receiver, and suitable connecting pipes.

798,260. William H. Bristol, New York, N. Y. **Insulating electrical conductors.** An intimate mixture of powdered carborundum and a solution of silicate of sodium is mixed to the proper consistency.

798,293. Francis J. Oakes, New York, N. Y. **Treating hides.** Hides are soaked in a bath containing about 5 per cent. their weight of sulphur, about 5 per cent. of glucose, and yeast.

798,294. **Same.** Hides are treated in a bath containing a mixture of sulphur and a putrefying excrementitious substance.

798,302. Maximilian Scharff and Franz Slama, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, same place. **Removing arsenic from gases.** Arsenic is removed from sulphurous gases by passing over an infusible granular substance like clay at a temperature between 200° and 400°.

798,332. James O. Green and Charles O. Pearse, Whitewater, Wis. **Brazing cast iron.** After cleaning the surfaces, an ordinary brazing powder capable of giving off carbon dioxide or oxygen is rubbed or forced into the surfaces, and the parts made while hot.

798,398. Gustave Dittmar, Washington, D. C. **Blasting compound.** Composed of nitroglycerol and the constituents of gunpowder, ammonium nitrate being the oxidant, imbedded in a fused carrier like paraffin.

798,436. Anton Mikolajczak, Castrop, Germany. **Dinitroglycerol.** An oily liquid having the formula  $C_3H_5OH(ONO_2)_2$ , solidifies at a lower temperature and is more soluble in water than trinitroglycerol. Made by reacting on glycerol with nitric acid, maintaining a low temperature and neutralizing the excess of acid.

798,482-3-4. James T. Armstrong and Axel Orling, London, England. **Electrocapillary apparatus.** A mercury reservoir in combination with a fluid conducting tube with a constricted end, which leads into a receptacle for dilute acid, and means for sending a current of electricity through the apparatus to disturb the equilibrium by changing the capillary condition of the liquid.

798,509. Richard Hartwig, Berlin, Germany. Assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. **Obtaining soluble starch.** At temperatures of from 50° to 86° F., raw starch in the dry form is treated with an excess of chlorine for from four to eight days.

WILLIAM H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Report of Investigation of Coal Deposits on the Batan Military Reservation, Batan Island, P. I.** BY H. L. WIGMORE, together with Extracts from Reports of the Secretary of War, the Quartermaster-General, U. S. Army, LIEUT. E. H. MARKHAM, and the Reports of MR. W. H. SMITH, Geologist, **On the Coal Deposits of Batan Island**, and LIEUT. H. L. WIGMORE **On the Coal Deposits of Polillo Island.** 71 pp.; maps. Washington: Government Printing Office, 1905.—This publication presents the results of preliminary examinations by means of tunnels and borings and surface observations, made with a view to possible government ownership of these promising coal fields. Tests under boilers on vessels show the coal from Batan to be superior to any other in the Philippine market that is derived from far eastern countries. It is essentially a bituminous coal, as shown by the numerous analyses accompanying the reports. W. F. HILLEBRAND.

**Geology and Water Resources of Oklahoma.** BY C. N. GOULD. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 148*, 178 pp.; maps, plates, figures.—The report states that there is little hope for artesian water in Oklahoma. By pumping, water may in general be obtained in fair quantities between the depths of 200 and 400 feet, but it is often so rich in salts as to be unfit for use. Below 400 feet the water is only fit for the manufacture of salt. There are quite a number of analyses of gypsums and a great number of partial analyses of well, stream and spring waters, all made by the teaching force and students of Oklahoma University. The waters are reported in grains per gallon, and a uniform system of combining the bases and acids seems to have been followed, one result of which is that sodium carbonate and sulphates and chlorides of calcium and magnesium are made to appear as coexistent in many waters. W. F. HILLEBRAND.



**The Chemical and Heat-producing Properties of Maryland Coals.** BY W. B. D. PENNIMAN AND ARTHUR L. BROWNE. *Maryland Geol. Survey*, Vol. V, pp. 619-636.—This is the concluding chapter in a very extensive *Report on the Coals of Maryland*, comprising more than half the volume, by Wm. B. Clark and numerous collaborators. The samples were collected and analyzed in accordance with the directions of the Committee on Coal Analysis of the American Chemical Society (this Journal, 21, 1116-1132). Only proximate analyses were made, but calorimetric values were determined in connection with nearly all of the 260 and more analyses. The commercial coals of Maryland are semi-bituminous and are used chiefly for smithing and steaming purposes. They are remarkably similar, and analysis cannot determine the part of the field from which a given sample comes.

W. F. HILLEBRAND.

**A Preliminary Report upon the Coal Resources of Wyoming.** BY L. W. TRUMBULL. *School of Mines, University of Wyoming, Bull.* 7, 95 pp.; maps, plates, figures.—About one-half of the hundred proximate analyses tabulated in this report are new, the rest being taken from earlier bulletins. Coal mining has become the leading industry of the state. It is estimated that the coal measures of the state cover an area of from 20,000 to 40,000 square miles, though much of the coal is of poor quality. High-grade coking coals and anthracite are lacking.

W. F. HILLEBRAND.

**Corundum and Its Occurrence and Distribution in the United States.** BY J. H. PRATT. *U. S. Geol. Survey, Bull.* 269, 175 pp.; maps, plates, figures.—This is a revised and enlarged edition of Bulletin 180 (see this Journal, 24, R 127). Many new modes of occurrence are described, over and above the 15 enumerated in the earlier work, and much space is devoted to the origin of corundum. The different methods of producing corundum artificially in recent years have materially aided in the development of theories as to its origin under varying conditions. There is also a list of 93 minerals associated with corundum in the United States.

W. F. HILLEBRAND.

**Underground Water Resources of Long Island, New York.** BY A. C. VEATCH, C. S. SLICHTER, ISAIAH BOWMAN, W. O. CROSBY AND R. E. HORTON. *U. S. Geol. Survey, Professional Paper No.* 44, 394 pp.; maps, plates, figures.—This very comprehensive report includes chapters on the following subjects: Outlines of Geology (Veatch); Underground Water Conditions (Veatch); Measurements of Velocity of Underflow (Slichter); Well Records (Veatch and Bowman) which include a good many analyses; Results of Sizing and Filtration Tests (Crosby); The Surface Streams (Horton).

W. F. HILLEBRAND.

**The Physical Geography, Geology, Mineralogy, and Paleontology of Essex County, Massachusetts.** BY J. H. SEARS. 418 pp.; maps, plates, figures. Published by the Essex Institute, Salem, Mass.—This profusely illustrated monograph embodies the results of years of work. Of interest to the mineral chemist will be the extended chapters on the igneous rocks with their analyses, a number of which by Dr. H. S. Washington are new, and the long list of mineral species. W. F. HILLEBRAND.

**Fire Tests of Some New York Building Stones.** BY W. E. MCCOURT. *New York State Museum, Bull. 100*, 38 pp.; plates.—Eight granites, gneisses and other igneous rocks, four sandstones, four limestones and one marble were subjected to the following tests. Six 3-inch cubes of each stone were prepared. Two were slowly heated in a Seger gas furnace to 550° C. and maintained at that temperature for half an hour; one was then cooled in air, the other by a stream of water. Two others were similarly heated at 850° and cooled like the former. The fifth cube was subjected to alternate heating on three sides by a steady but not strong gas blast and cooling in air. The sixth was heated as in the last case but cooled by a stream of water without removing the flame, and these operations were repeated. It is not possible to give here the detailed results of these tests which are illustrated by numerous photographs of the cubes after testing, for the reason that the effect of the heating and cooling was not only different under different conditions but the order was not the same. The tests seem to indicate that the more compact and hard a stone is the better will it resist extreme heat. Also in a general way, the greater the absorptive power or porosity of a stone the greater is the effect of heat. W. F. HILLEBRAND.

**The Lead and Zinc Bearing Rocks of Central Kentucky, with Notes on the Mineral Veins.** BY A. M. MILLER. *Kentucky Geol. Survey, Bull. 2*, 35 pp.; maps, plates.—Only the lower portion of the Ordovician rocks is considered in this report. Enough has been done to show that the Central Kentucky veins are of greater value than has been supposed, not only for their galena and sphalerite, but also for their barite and fluorite.

W. F. HILLEBRAND.

**The Mining Industry in North Carolina during 1903 and 1904.** BY JOSEPH HYDE PRATT. *North Carolina Geol. Survey, Economic Papers Nos. 8 and 9*, 74 and 95 pp. respectively.—These publications are chiefly statistical; of interest is the statement in regard to monazite that erosion and deposition are "going on to such an extent that even after the soils and gravels have been once worked they may be reworked at the end of a year and prove profitable." A few analyses are given, among them two of chromite.

E. C. SULLIVAN.

**The Occurrence of Sulphur and Celestite at Maybee, Michigan.** BY E. H. KRAUS AND W. F. HUNT. *Am. J. Sci.* **21**, 237-244; figures (for a somewhat less detailed paper on the same subject see 7th Ann. Rept. Michigan Acad. Sci., pp. 26-29).—The upper layer of rock, carrying some 14 per cent. of celestite, is dolomite, sometimes silicious and in many cases containing a relatively large percentage of bituminous matter. In the lower, more porous and cavernous strata is native sulphur, associated with celestite, calcite and gypsum. Iron is in but small quantity, hence pyrite cannot have been the source of the sulphur. A sulphide decomposable by dilute acid or by boiling water, with liberation of hydrogen sulphide (up to 0.12 per cent.) is present; this is probably strontium sulphide. The native sulphur is assumed to result from reduction of strontium sulphate to sulphide, doubtless by organic matter, and subsequent oxidation of the sulphide. Analyses of the rock and of the celestite are given. The latter gave (average of two analyses of clear crystals):  $\text{SiO}_2$ , 0.22;  $\text{Fe}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3$ , 0.14;  $\text{CaO}$ , 0.46;  $\text{MgO}$ , 0.13;  $\text{BaO}$ , 1.29;  $\text{SrO}$ , 53.77;  $\text{SO}_3$ , 43.59; total, 99.60. Crystallographic measurements were made, and a note on certain natural etch figures is appended.

E. C. SULLIVAN.

### ANALYTICAL CHEMISTRY.

**Opalescent Silver Chloride Precipitates.** BY ROGER CLARK WELLS. *Am. Ch. J.* **35**, 99-114.—A detailed discussion of the phenomena of opalescent precipitates. Single tubes of opalescence were compared with a plate of ground glass, as an arbitrary, constant standard of reference. Such a plate, when placed in a nephelometer, has exactly the appearance of an opalescent precipitate. The presence of electrolytes, as potassium nitrate and nitric acid, increases the intensity and hastens the deposition of opalescences. "Actual" silver chloride solutions attain their maximum values in twenty minutes and those by the precipitation of the silver or chlorine ion in about four minutes. This might cause an error of 0.002 per cent. in atomic weight determinations. The excess of precipitant required to give maximum values increases with dilution of the solutions. The shifting of the intensities of opalescences may be due to aggregation of the particles until they reach the limit of visibility, after which further aggregation decreases the exposed surface and, therefore, the opalescence. There is no good argument for assuming that silver chloride is a colloid.

F. C. MATHERS.

**The Use of Potassium Periodate in the Detection of Manganese, Cobalt and Zinc.** BY STANLEY R. BENEDICT. *Am. Ch. J.* **34**, 581 (1905).—The addition of 1 or 2 drops of a tenth-normal solution of potassium periodate to the neutral or ammoniacal



solution of a manganous salt produces at once a red precipitate. If manganese be present in but very small amount, a red coloration only is produced. In neutral solutions the precipitate retains its color, while in ammoniacal solutions it soon becomes brown or black. The foregoing facts may be utilized in the detection of manganese. The characteristic coloration is obtained even in a N/10,000 solution of manganous chloride. Potassium periodate produces a white precipitate when added to the solution of a zinc salt. If ammonium hydroxide and ammonium chloride are present, no precipitation occurs unless the zinc is present in large amount. Precipitation takes place, however, when the solution is heated to boiling. The following method for the qualitative detection and separation of manganese and zinc is proposed. The solution is treated with ammonium chloride and ammonium hydroxide. To a small portion of the solution is added one drop of potassium periodate solution. A pink or red coloration indicates manganese. If manganese is present, sodium phosphate is now added in slight excess to the main portion of the solution. This completely precipitates manganese in presence of ammonium salts, but does not precipitate zinc. The manganese is removed by filtration, and the zinc is detected in the filtrate either by the above-mentioned periodate test or by any other convenient method. The reaction between manganous salts and periodates may also be employed in the detection of periodic acid in the presence of iodic and hydriodic acids. In the presence of ammonium chloride and ammonium hydroxide, iodates give no coloration or precipitation with manganese. On the addition of a potassium periodate solution to the solution of a nickel salt a light-green precipitate is obtained. When the solution is boiled the precipitate may lose some of its greenish tint and become faintly gray in color. With solutions of a cobalt salt potassium periodate gives at first a dark-brown precipitate. Upon further addition of the reagent this precipitate becomes greenish in color. When the solution is heated the precipitate dissolves, forming a greenish black solution. Upon these facts the author bases a method for the detection of small amounts of cobalt in the presence of nickel. This method is in the author's opinion very reliable, and will detect 0.1 per cent. of cobalt in nickel solutions.

A. W. BROWNE.

**An Original Method for Estimating Naphthalene in Coal Gas.** (From Journal of Gas Lighting). *Am. Gas Light J.* **84**, 11 (1906).—An abstract of a paper recently read before the London Section of the Society of Chemical Industry, by Mr. C. J. D. Gair. Three methods for the determination of naphthalene in coal gas are described: (1) a modification of the method of Colman and Smith; (2) the method of Somerville; and (3) a gravimetric method devised by the author himself. (1) In accordance with this

method the gas to be tested is passed first through three Woulff bottles containing a measured amount of N/20 picric acid solution, and then through an experimental gas meter. The contents of the bottles are subsequently mixed together in a flask, and are heated on a water-bath to a temperature of about 60° C. until the precipitate of naphthalene and naphthalene picrate has entirely dissolved. To guard against decomposition of the latter substance by excessive heat, it is necessary to use a trap consisting of a beaker containing a small quantity of the original picric acid solution. After the entire solution has been allowed to cool, the crystals of naphthalene picrate are removed, dried *in vacuo*, and are weighed. If the coal gas under examination contains ammonia, a Woulff bottle containing a hot solution (80° C.) of oxalic acid is introduced in front of the bottles containing the picric acid solution. To guard against loss of naphthalene by condensation in the pipe leading to the apparatus it is advisable to have the apparatus as near the main as possible, and to surround the connecting pipe with a steam jacket. Instead of weighing the naphthalene picrate, the excess of picric acid remaining in the solution may be determined by titration with N/10 sodium hydroxide solution, and the amount of naphthalene present may be ascertained by calculation. (2) This method differs from that of Colman and Smith in that the naphthalene is first absorbed in 70 per cent. alcohol contained in glass tubes of appropriate construction. In case ammonia is present, a concentrated solution of oxalic acid is added to the solution. The naphthalene is precipitated out as naphthalene picrate by the addition of a concentrated solution of picric acid. The precipitate is filtered off, dried *in vacuo* and is weighed. (3) Absorption of the naphthalene is in this case effected by passing the purified gas through Woulff bottles or through towers containing about 350 cc. of acetic acid (sp. gr. 1.044). After the experiment has been completed, the solution is treated with about 500 cc. of concentrated picric acid solution. The naphthalene picrate is removed by filtration, dried *in vacuo* in a warm room and is weighed. The accuracy of the method was tested by experiments upon coal gas containing known amounts of naphthalene, and by comparison with the method of Colman and Smith. The method is in the opinion of Mr. Gair sufficiently accurate for all technical purposes. A. W. BROWNE.

**Provisional Methods for Copper, Lead and Zinc, of the Committee on Uniformity in Technical Analysis of the Western Association of Technical Chemists and Metallurgists.** *Chem. Eng.* 2, 5, 287, September, 1905.—The committee gives in concise form volumetric methods for the determination of copper, zinc, and lead in ores. They recommend the iodide method for copper, the ammonium molybdate method for lead, and the

ferrocyanide method for zinc. These methods recommended are practically the same as those outlined in modern textbooks.

FRANCIS C. KRAUSKOPF.

**Description of Methods Employed in Preparing Tables of Specific Gravity of Sulphuric Acid, Nitric Acid, Hydrochloric Acid and Ammonia.** BY W. C. FERGUSON. *J. Soc. Chem. Ind.* 24, 781 (1905).—The tables are based upon determinations made in the laboratories of the General Chemical Company by the author and his assistants. The determinations were made at 60° F. and were compared with water at 60° F. The purest reagents obtainable were used and were specially purified when necessary. The tables include degrees Baumé, specific gravity, per cent. acid or ammonia, degrees Twaddell and the change of specific gravity with temperature.

W. C. GEER.

## METALLURGICAL CHEMISTRY.

**Recent Progress in Metallurgy.** BY A. E. OUTERBRIDGE, JR. *J. Franklin Inst.* December, 1905.—Of the progress recently contributed by Americans, the author mentions Gayley's drying of blast-furnace blast, Clamer's method of eliminating zinc, tin and other impurities from scrap brass, so as to make merchantable bronze therefrom, the Canadian Government experiments on the electric production of iron and steel at Sault Ste. Marie, the production of pure iron electrolytically on a large scale by Prof. C. F. Burgess, and the great advances in the manufacture and utilization of aluminium.

J. W. RICHARDS.

**Equipment of a Small Electrochemical Laboratory.** BY W. H. EASTON. *Chem. Eng.* September, 1905.—An enumeration and description of the absolute minimum of apparatus required to do electrometallurgical experimenting or analytical determinations.

J. W. RICHARDS.

**Artificial Furnace Gas.** BY J. W. RICHARDS. *Electrochemical and Metallurgical Industry*, November and December, 1905.—A discussion of, and calculations upon, simple gas producers, Mond gas, and water gas, showing the efficiency of gasification (60 to 98 per cent.), the saving in efficiency by using steam in the producers (up to 20 per cent.), the net total efficiency of the producers as measured by the ratio of the calorific power of the gas to that of the coal from which it is obtained (60 to 90 per cent.).

J. W. RICHARDS.

**Blast-furnace Gases.** BY J. HERMAN. *Eng. Min. J.* October 21, 1905.—An investigation of gases from Arizona matte smelting furnaces, giving very useful and important information. At Morenci, with much fines, ore column 8 feet high, and 10.6



per cent. of fixed carbon charged, only 60 per cent. of the oxygen blown into the furnace is consumed. Analysis,  $\text{CO}_2$  from fuel 8.3 per cent., from carbonates 2.6,  $\text{SO}_2$  2.5,  $\text{CO}$  2.15,  $\text{O}$  8.00. Temperature at top of charge  $438^\circ\text{C}$ . ( $840^\circ\text{F}$ .). At Douglas, the gases contain 10 per cent. of free oxygen, with no carbon monoxide. Where the ores are well bedded, carbon monoxide is avoided in the gases. At Globe, a 9-foot ore column, quite open, is run with 10 per cent. of fixed carbon; the gases are at  $590^\circ$  to  $650^\circ\text{C}$ . ( $1100^\circ$  to  $1200^\circ\text{F}$ .), no free oxygen occurs in them, but 18 per cent. of the carbon is burned to carbon monoxide. Analysis,  $\text{CO}_2$  from fuel 14.1,  $\text{CO}_2$  from limestone 3.1,  $\text{SO}_2$  3.5,  $\text{CO}$  3.2. The hot gases carry out half of all the heat generated in the furnace. At Morenci and Douglas 70 per cent. of the sulphur in the charge is burned, at Globe 65 per cent. A definite amount of blast can burn only a definite amount of coke and pyrites, and any excess of fuel above that absolutely necessary means less ore smelted per day. An excess of coke will make hotter slag, will throw a much higher percentage of heat into the gases, and will delay the charge.

J. W. RICHARDS.

**Fluorine in Blast-furnace Slags.** BY L. S. AUSTIN. *Eng. Min. J.* November 11, 1905.—Some lead or copper ores contain much fluorspar; those of the Nina Vera in Northern Mexico furnish slag with as much as one-sixth of its lime combined with fluorine. In aiming at slag with a certain percentage of lime, the amount necessary to satisfy the fluorine present must be allowed for. Also, care must be taken that silica is not determined too low in the analysis, since some will be carried off by the hydrofluoric acid while evaporating to dryness to render silica insoluble. It is usual, in practice, to digest the ore with acetic acid, and to consider the lime not thus taken into solution as representing the fluorine present. This would be erroneous in the presence of many lime silicates.

J. W. RICHARDS.

**Control of Fire in Sulphide Ore.** BY W. M. SEAMANS. *Eng. Min. J.* November 11, 1905.—Instead of drawing the gases out of the mine, the ventilating fans are turned so as to force air in. This forces the gases through the cracked and fissured ore body into the ground, and soon frees the workings of gas, right up to the ore face. The plan has already worked successfully in several instances, and is a very pretty application of the principles of combustion.

J. W. RICHARDS.

**The Evolution of Tap Jackets and Spouts.** BY H. W. HIXON. *Eng. Min. J.* October 14, 1905.—A description of various designs, concluding with description of the latest, now used by the Canadian Copper Company. The box is water-jacketed, lined with chrome brick and provided with a bronze overflow. For tap blocks,

carbon blocks such as are used for electrodes in electric smelting are bored with a 2-inch hole, and the matte stream acts on it less than on either cast iron or chrome brick. Copper-nickel matte is more corrosive than ordinary copper matte.

J. W. RICHARDS.

**Electrolytic Copper.** By L. ADDICKS. *J. Franklin Inst.*, December, 1905.—Discussion of the multiple system of refining. In American refineries high-grade anodes are universally used, carrying copper 98 to 99.5 per cent., silver up to 300 oz. per ton, gold up to 40 oz. per ton, arsenic up to 2 per cent., and small amounts of Sb, Bi, Fe, Ni, S, Se, Te and Si. Arsenic is the most difficult impurity to deal with. The slimes are chiefly metallic, and commonly contain silver 40 per cent., gold 2, copper 25, selenium and tellurium 5, arsenic and antimony 10, lead, silica, sulphuric acid, etc., 18 per cent. Almost all the copper present is very finely divided, a large part passing a 200-mesh screen, and evidently formed from the oxidation of cuprous sulphate. The cathode copper is usually 99.93 per cent. pure. Of the impurities present, their effect on electrical conductivity is as follows: 0.01 per cent. of the elements named reduce the conductivity the percentage stated: phosphorus 22, arsenic 6, aluminium 5.5, iron or antimony 2, silicon or tin, 0.4, zinc 0.3, silver, gold, bismuth, cadmium, lead, sulphur or tellurium 0.2. Oxygen *increases* the conductivity, probably because it counteracts the bad effects of arsenic and antimony by oxidizing them out; 0.01 per cent. increases the conductivity 1 per cent., and 0.03 per cent. 2 per cent., attaining a maximum increase of 2.5 per cent. at 0.06 per cent. oxygen. Concerning conductivity of the solution, the copper present in it should not exceed 3 per cent., equal to 12 per cent. of crystallized copper sulphate, while the acid may be advantageously run up to about 13 per cent. Of the voltage drop per tank, 15 per cent. is due to metallic resistances, 20 per cent. to contacts, 60 per cent. to resistance of the electrolyte, and 5 per cent. to counter electromotive force due to the greater concentration of the electrolyte around the anode. On melting down the cathodes, the bath is oxidized until 6 per cent. of cuprous oxide is in solution, then poled until this is reduced to about 0.6 per cent. (0.065 per cent. oxygen), which gives maximum conductivity.

J. W. RICHARDS.

**Lime Roasting of Galena.** By W. M. HUTCHINGS. *Eng. Min. J.* October 21, 1905.—Discussion of the Huntington and Heberlein, Carmichael and Savelsberg processes. Experiments showed that by putting galenite ore into a scorifier, in a muffle, it ignited and roasted much slower than if mixed with lime or calcium carbonate or sulphate. The presence of either of these substances greatly accelerates the obtaining of a dead-sweet roast, forming lead oxide and calcium sulphate. On further oxidizing, with the

addition of silica, a fritted mass of lead-lime silicate is obtained, the sulphuric acid being driven off by the superior tendency to form silicate.

J. W. RICHARDS.

### The Microstructure of Silicon and Alloys Containing Silicon.

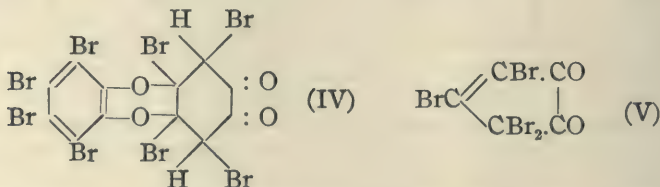
BY A. B. ALBRO. *Electrochemical and Metallurgical Industry*, November and December, 1905. (Read before the American Electrochemical Society.)—A long paper on a subject very little studied, containing 46 excellent micro-photographs and the author's studies and conclusions therefrom. The materials shown are graphitoidal silicon, silicon crystals, silicon nodules, ferro-silicon of 32, 50, 52 and 75 per cent. silicon, silicon copper with 2.3 and 10.12 per cent. silicon, admixtures of silicon and silicon carbide with 20 per cent. of the carbide, and the saturated mixture of Si and SiC corresponding closely to the formula  $\text{Si}_2\text{C}$ , and called by Dr. Potter "carbosilicon." This is a very tough, homogeneous compound, entirely different from either silicon or carborundum. Another conclusion from the study is that solid carbon and melted silicon do not necessarily react. Silicon containing 20 per cent. of silicon carbide shows a peculiar mottled appearance, the white portions containing amorphous silicon carbide, the dark portions being silicon. The many details cannot be reproduced in abstract; the general conclusion is that silicon has a remarkable influence on the structure of anything with which it enters into solution or combination.

J. W. RICHARDS.

## ORGANIC CHEMISTRY.

### On Certain Derivatives of Tetrabromorthobenzoquinone.

BY C. LORING JACKSON AND F. W. RUSSE. *Am. Ch. J.* 35, 154-187.



—The ketones, acetone, diethylketone, mesityl oxide, and acetophenone react easily on the quinone but the products are the same in all cases. These are the (I) red hexabromorthobenzoquinone,  $\text{C}_6\text{Br}_4\text{O}_2 \cdot \text{C}_6\text{Br}_2\text{O}_2$ , the (II) brown hexabromodihydroxybenzoquinone,  $\text{C}_6\text{Br}_4\text{O}_2 \cdot \text{C}_6\text{Br}_2(\text{OH})_2$ , and (III) a yellow compound shown to be heptabromorthobenzoquinone hemiether,  $\text{C}_6\text{Br}_4(\text{OH})\text{OC}_6\text{Br}_3\text{O}_2$ , the relative amounts of each depending on the conditions of experiment. In every case a



bromketone was formed as a by-product. Reactions:  $2\text{C}_6\text{Br}_4\text{O} + \text{C}_6\text{H}_5\text{COCH}_3 = (\text{III}) \text{C}_6\text{Br}_4(\text{OH})\text{OC}_6\text{Br}_3\text{O}_2 + \text{C}_6\text{H}_5\text{COCH}_2\text{Br}$ .  $\text{C}_6\text{Br}_4(\text{OH})\text{OC}_6\text{Br}_3\text{O}_2 = (\text{I}) \text{C}_6\text{Br}_4\text{O}_2 \cdot \text{C}_6\text{Br}_2\text{O}_2 + \text{HBr}$ .  $\text{C}_6\text{Br}_4\text{O}_2 \cdot \text{C}_6\text{Br}_2\text{O}_2 + 2\text{HBr} = (\text{II}) \text{C}_6\text{Br}_4\text{O}_2 \cdot \text{C}_6\text{Br}_2(\text{OH})_2 + \text{Br}_2$ . Oenanthol and benzaldehyde give the red and yellow products obtained with ketones. The black quinhydrone of Zincke was found to be easily prepared from equimolecular amounts of tetrabromorthoquinone and tetrabrompyrocatechol. Composition:  $\text{C}_6\text{Br}_4(\text{OH})_2 \cdot \text{C}_6\text{Br}_4\text{O}_2 \cdot \text{H}_2\text{O}$ . It is believed to be a quinhydrone of the formula (IV) because of its synthesis and its marked color and composition, apart from the unexplained molecule of water. It easily passes to the hemiether (III). The action of acetic acid on tetrabromorthoquinone, under varying conditions, gave the hemiether (III), or thick rhombic plates not melting under  $300^\circ$ , or a yellow compound melting between  $235^\circ$  and  $250^\circ$ . The last was also obtained by repeated crystallization of the second and by action of formic acid on the original quinone. Analysis indicated an ether  $(\text{C}_6\text{Br}_4\text{O} \cdot \text{C}_6\text{Br}_3\text{O}_2)_2\text{O}$ . Other aliphatic acids gave results similar to acetic acid. On boiling the tetrabromorthoquinone with fuming nitric acid and bromine two new compounds were obtained, a white acid and a yellow substance believed to be (V) because of its analysis and the fact that it reacts with orthodiamines, giving a product that gives a red color with sulphuric acid which is characteristic of quinoxalines of this class. *Experimental*.—The quinone on standing four to five days in anhydrous acetone gave the red hexabromorthoquinopyrocatechol ether. On longer standing this changed to hexabromdihydroxypyrocatechol ether. This brown substance was found to crystallize also as fine white needles and pale yellow plates. The yellow product, *heptabromorthoquinopyrocatechol hemiether*,  $\text{C}_6\text{Br}_4(\text{OH})\text{O} \cdot \text{C}_6\text{Br}_3\text{O}_2$ , was obtained by mixing half its weight of acetone with the quinone and allowing the mixture to stand two to three days, or better, by diluting this mixture with ten parts of benzene. Large yellow plates or prisms from benzene; efflorescent; melting-point,  $244\text{--}245^\circ$  with decomposition; soluble in hot benzene, chloroform, ether or nitrobenzene; insoluble in ligroin. Alcohols convert it to the red compound (I) as do many other reagents or even long exposure to the air. Zinc and acetic acid reduce it to hexabromdihydroxypyrocatechol ether. Benzoyl chloride converts it to *tribenzoylheptabromdihydroxypyrocatechol hemiether*,  $\text{C}_6\text{Br}_4(\text{OCOC}_6\text{H}_5)\text{O} \cdot \text{C}_6\text{Br}_3(\text{OCOC}_6\text{H}_5)_2$ ; plates from benzene melting at  $294\text{--}296^\circ$ . They are soluble in benzene and in nitrobenzene; sparingly so in alcohol; insoluble in water and ligroin. Benzoyl chloride and tetrabromorthobenzoquinone gave a product melting at  $172\text{--}174^\circ$ . Analysis indicated tetrabrompyrocatechol dibenzoate, but that body melts at  $197^\circ$ . *Dibenzoate of Tetrabrompyrocatechol*, from tetrabrompyrocatechol and benzoyl chloride,

crystallizes in square plates, and melts at  $197^{\circ}$ . Soluble in benzene or chloroform; slightly so in hot alcohols; insoluble in ligroin. The action of tetrabromorthoquinone and the other ketones mentioned was quite similar to that with acetone. The octabromorthoquinhydrone,  $C_6Br_4O_2 \cdot C_6Br_4(OH)_2 \cdot H_2O$ , of Zincke was prepared by bringing together equimolecular amounts of tetrabrompyrocatechol and tetrabromorthoquinone in chloroform solution. Shining black needles or slender prisms from chloroform. Soluble in chloroform, ether, or benzene; slightly soluble in ligroin; insoluble in water. Warm solvents cause a partial change to heptabromorthoquinopyrocatechol hemiether and tetrabrompyrocatechol. The same change is produced by heating the quinhydrone dry at  $110^{\circ}$ , bromine and water being given off. Heating with alcohol gives the red hexabrom ether given above. The quinhydrone is reduced to tetrabrompyrocatechol by passing sulphur dioxide through its benzene solution. Acetic anhydride gives *tetrabrompyrocatechol diacetate*,  $C_6Br_4O_2(C_2H_3O)_2$ ; square colorless plates, melting at  $215-216^{\circ}$ . Soluble in chloroform or hot alcohol, benzene, or ether; insoluble in water or ligroin. *Tetrabromorthoquinone and Organic Acids*.—Cold acetic acid gave an addition product,  $(C_6Br_4O_2)_2(C_2H_4O_2)_3$ , square white rhombic plates, not melting under  $300^{\circ}$ , soluble in alcohol, ether, benzene, or chloroform. Repeated crystallization from benzene gave yellow needles melting at  $235-250^{\circ}$ . Warm acetic acid did not give the products obtained by Koch or Porter but always *diheptabromorthoquinopyrocatechol ether*,  $(C_6Br_4O \cdot C_6Br_3O_2)_2O$ ; yellow needles melting at  $235-250^{\circ}$ , soluble in ether, alcohol, or carbon disulphide. Formic, propionic, butyric, and isovaleric acids gave the same yellow ether. Fuming nitric acid and bromine or the acid alone gave two products with the tetrabromquinone. *Tetrabromcyclopenteneorthoquinone* (provisional); yellow plates, m. p.  $142^{\circ}$ , soluble in alcohol, ether, chloroform, benzene, or acetone. It condenses with orthophenylenediamine to a brown body that gives a red color with sulphuric acid. The second compound formed with nitric acid and bromine crystallizes in white needles melting at  $144-146^{\circ}$  and is soluble in water with an acid reaction.

V. J. CHAMBERS.

**On the Addition-Products of *p*-Nitrosodimethylaniline with Certain Phenols.** BY HENRY A. TORREY AND J. A. GIBSON. *Am. Ch. J.* 35, 246-253.—*p*-Nitrosodimethylaniline forms addition-compounds with certain substituted mono- and diacid-phenols that show a considerable degree of analogy to phenoquinone and quinhydrone. *Trichlorophenol and p-Nitrosodimethylaniline*,  $ONC_6H_4N(CH_3)_2 \cdot (C_6H_2Cl_3OH)_2$ .—A concentrated benzene solution of the phenol was added to a similar solution of the aniline. On diluting with ligroin fine reddish crystals were obtained, m. p.  $91^{\circ}$ . Readily soluble in cold chloroform, alcohol, acetone, and benzene;

soluble in ether; insoluble in cold ligroin. All solutions show the green color of *p*-nitrosodimethylaniline, and molecular weight determinations show that the addition compound is entirely dissociated in these solvents to *p*-nitrosodimethylaniline and trichlorophenol. *With tribromphenol*,  $\text{ONC}_6\text{H}_4\text{N}(\text{CH}_3)_2 \cdot (\text{C}_6\text{H}_2\text{Br}_3\text{OH})_2$ .—Dark red crystals were obtained in a similar manner. The action towards solvents was similar to that of the trichlorophenol derivative. *With salicylic acid*,  $\text{ONC}_6\text{H}_4\text{N}(\text{CH}_3)_2 \cdot (\text{HO} \cdot \text{C}_6\text{H}_4 \cdot \text{COOH})_2$ .—An orange-red crystalline precipitate that recrystallized from benzene as fine dark red crystals, m. p.  $110^\circ$ . *With trichlororesorcinol*,  $\text{ONC}_6\text{H}_4\text{N}(\text{CH}_3)_2 \cdot \text{C}_6\text{HCl}_3(\text{OH})_2$ .—Dark blue crystals, soluble in benzene, ether, chloroform, alcohol, and acetone, with a green color. Practically completely dissociated in solution. *With tribromresorcinol*,  $(\text{ONC}_6\text{H}_4\text{N}(\text{CH}_3)_2)_2 \cdot \text{C}_6\text{HBr}_3(\text{OH})_2$ .—Light olive-green crystals, melting at  $115^\circ$ . Solubilities similar to the trichlororesorcinol derivative. *With Pyrocatechol*,  $(\text{ON} \cdot \text{C}_6\text{H}_4\text{N}(\text{CH}_3)_2)_2 \cdot \text{C}_6\text{H}_4(\text{OH})_2$ .—Fine olive-green crystals, melting with decomposition at  $125^\circ$ . Soluble in organic solvents with a green color. Paranitrosodimethylaniline is frequently given the quinone formula, and inasmuch as Posner has shown that in phenoquinone and similar compounds the point of addition of the phenol is probably at the double bonds, and since this constitution is in harmony with the dissociation of the compounds, the authors feel justified in suggesting that these addition compounds of *p*-nitrosodimethylaniline are of a similar nature.

V. J. CHAMBERS.

**On the Behavior of Benzoyl Carbinol towards Alkalies and Oxidizing Agents.** BY WM. LLOYD EVANS. *Am. Ch. J.* **35**, 115–144.—Nef, in a previous article, had come to the conclusion that benzoyl- and acetylformaldehydes, respectively, must first be formed by the action of oxidizing agents on benzoyl- and acetylcarbinols and that these aldehydes are then converted to mandelic and lactic acids by a benzilic acid rearrangement; also that in

such rearrangement of an orthodicarbonyl compound,  $\begin{array}{c} \text{XC:O} \\ | \\ \text{YC:O} \end{array}$ , it

dissociates into  $\text{XYC:O}$  and  $\text{>C:O}$ , the products of dissociation

uniting to form the addition compound  $\begin{array}{c} \text{X} \quad \text{O} \\ \diagdown \quad \diagup \\ \text{C} \quad \text{C:O} \\ \diagup \quad \diagdown \\ \text{Y} \end{array}$  which, by

hydrolysis, gives the  $\alpha$ -hydroxy acid. A quantitative study of the behavior of benzoylcarbinol and of benzoylformaldehyde with oxidizing agents, under various conditions, indicates the correctness of these conclusions of Nef. **EXPERIMENTAL.**—Benzoylcarbinol was best prepared by boiling benzoylcarbinol acetate with 17 parts of water for twelve hours. *Action of Benzoyl-*



*carbinol with Copper Salts.*—Aqueous copper acetate or sulphate (in the cold) gave benzoylformaldehyde, benzoic acid, and *r*-mandelic acid; at 100°, copper acetate gave benzoic acid, *r*-mandelic acid, and a trace of benzoylformic acid. A previous experiment had shown that benzoylformaldehyde gives *r*-mandelic acid when heated to 100° with aqueous copper acetate. *Benzoylcarbinol and Cupric and Sodium Hydroxides* gave a good yield of mandelic acid with small amounts of benzoic and benzoylformic acids. Bromacetophenone gave the same products by a similar treatment, the benzoic acid being in largest amount. *Benzoylcarbinol, Potassium Hydroxide and Potassium Ferricyanide.*—Mandelic acid and a trace of benzoic acid were obtained. Benzoylformaldehyde hydrate gave a quantitative yield of mandelic acid. Acetophenone, with the same reagents, gave benzoylformic and benzoic acids, but no trace of mandelic acid. *Benzoylcarbinol and Potassium Permanganate.*—Benzoic acid, but no trace of mandelic or benzoylformic acids, though with permanganate and sodium hydroxide benzoylformic acid was obtained in large amount. Benzoylformaldehyde and potassium permanganate gave benzoic acid, while with sodium hydroxide and permanganate it gave benzoylformic and benzoic acids. It is obvious that the benzoic acid formed with permanganate alone may come, in the case of benzoylcarbinol, in part from an oxidation of the dissociated portions,  $C_6H_5COCH_2OH \rightleftharpoons C_6H_5CHO + \text{>}CHOH$ . In the presence of caustic alkali, however, as well as in all cases with benzoylformaldehyde, this must be formed exclusively from the oxidation of the dissociated benzoylformaldehyde hydrate molecules,  $C_6H_5COCHO \rightleftharpoons C_6H_5CHO + \text{>}C=O$ , it having been shown that the oxidation cannot be first to the benzoylformic acid and then to the benzoic acid, as benzoylformic acid, is not oxidized to benzoic acid under similar conditions. The formation of benzoylformic acid cannot possibly be by a direct oxidation of molecular benzoylformaldehyde because, in that case, this acid should have been obtained from the aldehyde by aqueous permanganate alone and without the formation of any benzoic acid. The benzoylformaldehyde passes first to mandelic acid and then this is oxidized to benzoylformic acid. *Benzoylcarbinol and silver oxide* gave benzoic acid only. Benzoylformaldehyde hydrate and silver oxide also gave benzoic acid. This must have come from the oxidation of the dissociated aldehyde as neither mandelic acid nor benzoylformic acid gave benzoic acid by a similar treatment. Experiments using mercuric oxide in place of silver oxide gave similar results. Oxidation of benzoylcarbinol, benzoylformaldehyde, benzoylformic acid, and mandelic acid, using bichromate of potassium and sulphuric acid, gave one result, benzoic acid. *Part II.*

*On the Behavior of Benzoylcarbinol towards Alkalies; A Revision of Paal and Schultze's Work on  $\alpha$ - and  $\beta$ -Halogen Diphenacyls.*—The author objects to the formula given by Paal and Schultze to their stereoisomeric  $\alpha$ - and  $\beta$ -halogen diphenacyls,  $\text{C}_6\text{H}_5\text{C}(\text{OH}) : \text{CBrCH} : \text{C}(\text{OH})\text{C}_6\text{H}_5$ . Another possible interpretation is: The benzoylmethylene, resulting from the dissociation of the bromacetophenone, may react by alkylation with unchanged bromacetophenone, in the enol form, and thus give rise to stereoisomeric *cis*- and *trans*- $\alpha$ -phenacyl- $\omega$ -bromstyrols,  $\text{C}_6\text{H}_5\text{COCH} \begin{matrix} \searrow \\ \nearrow \end{matrix} + \text{C}_6\text{H}_5\text{C}(\text{OH}) : \text{CHBr} \rightarrow \text{C}_6\text{H}_5\text{COCH}_2\text{OC}(:\text{CHBr})\text{C}_6\text{H}_5$  (*cis* and *trans* forms). The following reactions can readily be explained by this formula: Dry hydrobromic acid acts on both isomers giving an odor of bromacetophenone. The isomers, with fused sodium acetate in acetic acid, give benzoylcarbinol acetate. Similar treatment of  $\alpha$ - or  $\beta$ -acetoxydiphenacyl gave similar results.  $\beta$ -Oxydiphenacyl was obtained in crystalline form by heating either  $\alpha$ - or  $\beta$ -bromdiphenacyl in a sealed tube with a methyl alcoholic solution of potassium formate. Difficultly soluble in cold benzene or ether. Microscopic needles from benzene, melting at  $175$ – $178^\circ$ . It gave benzoylcarbinol acetate with fused sodium acetate and acetic anhydride. With acetic anhydride alone it gave  $\beta$ -acetoxydiphenacyl. Reduction of the isomeric halogen diphenacyls with zinc dust and alcohol gave about 10 per cent. each of diphenacyl and acetophenone, the main reaction product being probably  $\alpha$ -phenacyloxystyrol,  $\text{CH}_2 : \text{C}(\text{C}_6\text{H}_5)\text{OCH}_2\text{COC}_6\text{H}_5$ .

V. J. CHAMBERS.

## BIOLOGICAL CHEMISTRY.

**The Germicidal Action of Potassium Permanganate.** BY JAMES B. GARDNER AND WALTER E. KING. *Am. Ch. J.* **35**, 144–148.—It is shown that an N/458 solution of potassium permanganate is germicidal to a pure twenty-four hour bouillon culture of *Bacillus typhosus*.

F. P. UNDERHILL.

**An Examination of the Methods for the Microchemical Detection of Phosphorus Compounds Other than Phosphates in the Tissues of Plants and of Animals.** BY R. R. BENSLEY. *Biol. Bull.* **10**, 49–66.—It is shown in this article that there is no hope for a real phosphorus microchemical reaction to be obtained by the nitric molybdate reagent. This does not apply to the identification of phosphates by the nitric molybdate reagent in cases where the characteristic crystal form of the ammonium phosphomolybdate can be recognized under the microscope.

F. P. UNDERHILL.

**A Physico-chemical Theory of Fertilization.** BY MARTIN F. FISCHLER AND WOLFGANG OSTWALD. *J. Am. Med. Assn.* **46**,

423-429.—Briefly stated, fertilization is a process identical with the process of a localized and oriented gelation.

F. P. UNDERHILL.

**The Effect of Eosin upon Tetanus Toxin and upon Tetanus in Rats and Guinea-pigs.** BY SIMON FLEXNER AND HIDEYO NOGUCHI. *J. Expt. Med.* 8, 1-8.—These experiments embrace the study, first of aniline dyes upon tetanolysin; second, the effect of eosin upon tetanospasmin; and third, the influence of eosin upon the course of experimental tetanus in rats and guinea-pigs. The results show that aniline dyes, chiefly those possessing fluorescence, have an injurious effect upon the labile haemolysin in the dark, although the effect is less than in the light. Eosin in solutions exceeding 1 per cent. in strength quickly destroys tetanospasmin in the dark, and in 0.6 per cent. solutions reduces greatly the activity of the poison. In a series of experiments the effect of eosin upon the course of tetanus consisted in delaying the onset of symptoms and of prolonging the period of intoxication. The power of eosin to destroy or modify the tetanic poison although marked is not absolute.

F. P. UNDERHILL.

**Cystinuria.** BY W. MCKIM MARRIOTT AND CHARLES G. L. WOLF. *Am. J. Med. Sci.* 131, 197-203.—In a case of cystinuria reported the urine contained significant quantities of diamines.

F. P. UNDERHILL.

**Researches on the Blood of Epileptics.** BY B. ORNOF AND HORACE LOGRASSO. *Am. J. Med. Sci.* 131, 269-285.—A certain relationship appears to exist between epileptic seizures and leucocytosis, although the two do not appear to run together.

F. P. UNDERHILL.

**Some Micro-chemical Reactions. II.—Notes on Methods for the Localization of Potassium and Phosphorus.** BY MARTHA TRACY. *J. Med. Research*, 14 (New Series 9), 447-455.—The author finds that the method of Macallum for the detection of potassium in tissues (*J. Physiol.* 32) is not sufficiently reliable to be of any real value. It is also shown that the nitric molybdate reagent method gives a fairly accurate estimate of the amount of phosphorus-containing proteids present. (Compare Bensley: *Biol. Bull.* 10, 49-66.) See also abstract this review, p. 193.

F. P. UNDERHILL.

**Studies on the Toxicity of the Bile. II.—The Toxic Effects of Bile upon the Central Nervous System and the Elimination of Strychnine through the Bile of Nephrectomized Animals.** BY S. J. MELTZER AND WILLIAM SALANT. *J. Expt. Med.* 8, 127-167.—The results of this investigation may be summarized as follows: That contrary to the prevailing opinion, bile contains a tetanic element, or an agent which causes increase of excitability



of the nervous system. Bile from the common duct of many rabbits causes marked hyperaesthesia and tetanic attacks when injected into frogs. Stagnant bile (as in the gall bladder, etc.) invariably produces coma and paralysis. The depressive and exciting elements of the bile are mutual antagonists, the total effect of both, when simultaneously present, being that of an algebraic sum. The depressive element when present in a highly effective dose is by far the stronger of the two, while, on the other hand, the tetanic element becomes effective apparently in a dose far below that which constitutes the minimum for the depressive element. Owing to these peculiar characteristics of the two antagonistic toxic elements, the mixture of both within the bile can be so adjusted as to produce any of the many possible degrees of irritability lying within the range of tetanus at one end and paralysis at the other, and including a neutral state presenting apparently a normal or tranquil condition. Bile salts seem to contain the tetanic element in a distinctly less amount than the whole bile. Nephrectomy increases the toxicity of the bile in the direction of excitation. Nephrectomy can be imitated by subcutaneous injections of strychnine. Bile of nephrectomized rabbits which received strychnine produces hyperaesthesia and convulsions more readily than any other bile. By injecting a toxic dose of strychnine into a frog soon after it has received a distinctly depressing dose of bile, an "eclamptic" state can sometimes be produced.

F. P. UNDERHILL.

**The Constituent of the Bile Causing Pancreatitis and the Effect of Colloids upon its Action.** BY SIMON FLEXNER. *J. Expt. Med.* 8, 167-178.—In this investigation it is shown that the bile salts are capable of setting up an inflammation of the pancreas of high degree and that this inflammation can be restrained by the injection of colloidal solutions.

F. P. UNDERHILL.

**On the Carbohydrate Group in the Nucleoproteid of the Spleen.** BY P. A. LEVENE AND J. A. MANDEL. *J. Expt. Med.* 8, 178-180.—The authors have succeeded in obtaining from the spleen a substance presenting the properties of glucothionic acid, that is, a nitrogenous body composed of sulphuric acid and carbohydrate.

F. P. UNDERHILL.

**The Effect of Changes in Temperature upon the Viscosity of the "Living" Blood.** BY R. BURTON-OPITZ. *J. Expt. Med.* 8, 59-64.—These experiments, performed according to the method of Hürthle (*Arch. ges. Physiol.* 82, 415) were made upon dogs under light ether anaesthesia. It is shown that the viscosity of the blood reacts very sharply towards changes in the temperature of the surrounding medium. When the temperature is decreased (by cold baths) the viscosity of the blood is increased, and the viscosity is decreased by warm baths. Warm water

baths produced a decrease and cold water baths an increase in the specific gravity of the blood. Hot air baths do not render the blood less viscous but more so, and the specific gravity of the blood becomes greater.

F. P. UNDERHILL.

**On a Certain Crystalline Body Obtained on the Prolonged Digestion of Gelatine.** BY P. A. LEVENE. *J. Expt. Med.* 8, 180-181.—On prolonged tryptic digestion of gelatin, a substance was isolated having the formula of  $C_7H_{10}N_2O_2$  and it is probably in some way related to prolin.

F. P. UNDERHILL.

**Temperature and Heart Activity with Special Reference to the Heat Standstill of the Heart.** BY A. J. CARLSON. *Am. J. Physiol.* 15, 207-235.—The influence of temperature variations on the whole heart of *Limulus* is the same as that on the heart of cold-blooded vertebrates. There is the same augmentation of the rhythm by the higher temperatures, the same depression of the rhythm by the lower temperatures, the same heat stands still in diastole at  $32-42^{\circ}C.$ , the same return of the rhythm on lowering the temperature, the same heat rigor at  $45-55^{\circ}C.$  In the *Limulus* heart the heat standstill in diastole of the entire heart at  $32^{\circ}C.$  is due to paralysis of the motor nerve endings or to lessened excitability of the muscle itself to the extent that it is no longer able to respond to the impulses from the ganglion. The rhythm of the ganglion in the *Limulus* heart continues at temperatures up to  $42^{\circ}C.$ , at which point it is entirely suppressed and remains so as long as this temperature is maintained. The sudden rise of the temperature of the ganglion to  $35^{\circ}$  or  $40^{\circ}$  produces tonus and incomplete tetanus contractions of the heart muscle. The heat paralysis of the ganglion is accompanied by tonus relaxation of the heart muscle. The intrinsic motor nerves exhibit greater resistance to temperature variations than does the heart muscle or the ganglion, the upper limit for the nerves being about  $43^{\circ}C.$  The upper and lower limits beyond which the heart rhythm ceases are not fixed points but depend on the condition of the heart. The heat rigor of the heart following the rise of temperature above that producing paralysis of the muscles ( $32^{\circ}C.$ ) and the ganglion ( $40^{\circ}C.$ ) is due, not to stimulation of the ganglion or the nerves, but to direct action on the muscle.

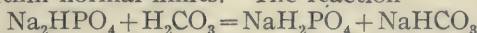
F. P. UNDERHILL.

**Galvanotropism of Volvox.** BY OLIVER P. TERRY. *Am. J. Physiol.* 15, 235-244.—*Volvox*, when in its normal condition, goes to the kathode. Cultures of *Volvox* kept for some time in media containing acids, alkalies, and salts, in insufficient quantities to kill, are not affected in their galvanotropic response by such media. *Volvox* is unaffected in its galvanotropism by moderate changes of temperature. If kept in the dark for two or three

days, the response of *Volvox* is changed from cathodic to anodic. This may then be reversed at will by exposure to light. Whether anodic or cathodic, *Volvox* always progresses with the same end (anterior) forward. Blue light has little or no effect while red light, which has the power to stimulate assimilation, affects the organisms like sunlight. The galvanotropism of *Volvox* depends upon its state of chlorophyll metabolism.

F. P. UNDERHILL.

**Equilibrium in Solutions of Phosphates.** BY LAWRENCE J. HENDERSON. *Am. J. Physiol.* **15**, 257-272.—The titratable acidity of urine varies materially with the temperature, partly because of the variation in the ionization of water with the temperature. The variation should be regarded in practical work, for it may produce errors of more than 5 per cent. The hydrogen ionization of blood serum corresponds to that of solutions of a mixture of  $\text{Na}_2\text{HPO}_4 + \text{NaH}_2\text{PO}_4$  in which the ratio of the two constituents varies between 6:4 and 1:0 approximately. Variation within this range being presumably harmless, protoplasm possesses in the phosphates, aided by their substances in less degree, a mechanism whereby great quantities of acid or alkali may be immediately neutralized and the hydrogen ionization preserved within normal limits. The reaction



is a balanced one, and even in solutions less acid than monosodium phosphate sodium bicarbonate cannot exist. Both the determinations of hydrogen ionization in urine and in phosphate solutions, and their behavior to methyl orange indicate that urine contains a mixture of mono and dihydrogen phosphates.

F. P. UNDERHILL.

**On the Relation of the Coagulation of the Colloids of the Otmophore Swimming-plate to Its Contractility.** BY R. S. LILLIE. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xii.—The normal rhythm of the swimming-plate of *Eucharis lobata* is usually from three to six beats per second. No change is seen in the substance of the plate during normal contraction. In certain solutions (*e. g.*, alkaline 6/10 M sodium chloride) the rhythm is greatly accelerated, and individual beats become indistinguishable. This abnormally active movement is always accompanied by a progressive coagulation of the colloids of the plate, the originally clear substance of which becomes clouded and opaque, usually within half a minute or less; movement then ceases. The coagulation does not begin until the plate has begun vibrating; inactive plates remain transparent. A connection between a coagulation of the colloid of the plate and its contractility is thus indicated. Probably the contraction phase in the normal beat is due to a partial coagulation of the colloids; this change is



reversed during the relaxation phase. The above solutions accelerate the coagulative phase of the process; hence the accelerated movement and the progressive coagulation of the colloids.

F. P. UNDERHILL.

**Concerning Peptone (Second Communication).** By L. B. STOOKEY. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xii.—This investigation is the study of peptone, of a fraction designated "I B Benzoyl Chloride." This fraction gave the biuret, Molisch and extremely faint xanthoproteic reactions. The Hopkins and Millon tests were negative. Sulphur was absent. The possible molecular formula of this substance is indicated as  $C_{29}H_{38}N_4O_{10}$ .

F. P. UNDERHILL.

**Vagus Inhibition of the Heart in Its Relation to the Inorganic Salts of the Blood.** By W. H. HOWELL. *Am. J. Physiol.* **15**, 280-295.—In a medium circulating through the terrapin or frog heart and containing only sodium, potassium and calcium chlorides, an increase in the amount of the potassium salt augments the sensitiveness of the heart to vagus inhibition, until the amount of the potassium becomes sufficiently large to cause itself marked inhibitory effects. Under the last condition the effect of vagus inhibition is greatly lessened. Complete lack of potassium salts is attended by a diminution in, or entire loss of, vagus control of the different chambers of the heart. A solution containing only sodium chloride (0.7 per cent.) causes loss of vagus control of the heart beats. An increase in the calcium salts (0.023 to 0.138 per cent.) has no effect upon vagus inhibition of the auricles. The same change is followed by diminution and finally entire loss of vagus action on the ventricle (terrappin), owing probably to the development of an independent ventricular rhythm. The results of the experiments are interpreted to indicate that inhibition of the heart depends upon the presence of diffusible potassium compounds on the heart tissue, and that vagus impulses act indirectly by increasing the amount of potassium compounds of this character.

F. P. UNDERHILL.

**A Reflex Respiratory Centre.** By IDA H. HYDE. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xi.—An investigation showing that in *Limulus* the respiratory centres are reflex in character.

F. P. UNDERHILL.

**A Preliminary Study of the Chemistry of Nerve Tissue Degeneration.** By WALDEMAR KOCH AND WILLIAM H. GOODSON. *Am. J. Physiol.* **15**, 272-280.—The tissues analyzed in this investigation included three normal brains, three brains from cases of general paralysis of the insane and the spinal cords of two dogs—one normal, the other degenerated. The results of the analyses of the normal tissues are as follows: The gray matter of

the prefrontal and motor areas differs very little in composition. The differences are within the limit of error. The corpus callosum differs markedly from the gray matter. The amount of proteids is less and the amount of cerebrin greater. The lecithin and cephalin are very nearly the same as for the gray matter, but relatively to the proteids they are increased, although not so much as the cerebrins, which according to Noll are found only in medullated fibres. The relation of lecithins and cephalins to one another shows no change that cannot be accounted for by uncertainties in the method, which at the time some of these analyses were made had not been so well worked out. The extractions and salts are markedly less than in the gray matter when calculated in per cent. of total solids, but not with calculations made for moist tissues. Comparison of the corpus callosum and sciatic nerve reveals the fact that the two differ markedly in composition. The amount of sulphur compound found combined with the lipoids is greater in the corpus callosum than in the gray matter, and even greater in the sciatic nerve than in the corpus callosum. The degenerated nerve tissues contain less solids than the normal, due to the fact that as the cortex wastes away, cerebro-spinal fluid partially takes its place and renders the tissues more watery. A certain amount of oedema may also play a part in rendering the tissues more watery. The nucleoproteids are increased, due mainly to the presence of large numbers of leucocytes, proliferating blood vessels, elements, and neuroglia cells. The average and the maximum results indicate little or no change in lecithins, cephalins, and sulphur compound (combined), in the prefrontal as well as the motor areas, which cannot be accounted for by variations in the material. The amount of cerebrin in the motor area (degenerated) indicates that these samples contained a larger admixture of white matter. The experimental degeneration produced by cutting the cord of a dog and allowing it to degenerate for nineteen days gives results on chemical analysis which resemble the degeneration of general paralysis. There is a similar increase in the amount of water and nucleoproteid, and comparatively little as regards the relative amounts of the other constituents. The absolute amounts of lecithins, cephalins, cerebrins, and sulphur compound must be very much reduced in general paralysis; their proportion relative to one another remains, however, practically unchanged. It is interesting to note that the nervous system more than any other tissue, both in pathological and experimental degeneration, tends to keep its relative composition constant, which observation is in harmony with the results obtained in starvation.

F. P. UNDERHILL.

**The Alimentary Enzymes of the Embryo.** BY LAFAYETTE B. MENDEL. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xiii-xiv.

—The observations on the occurrence of enzymes in the alimentary tract of the embryo, here briefly summarized, form part of a study of the development of physiological processes in growth and the equipment of growing organisms for their nutrition. Extracts of the entire intestine of embryo pigs of various ages have been examined by a diversity of methods for sucrase, maltase and lactase. Maltase appears to be the most universal of all these enzymes. In the embryo pig lactase is present very early, while sucrase cannot be detected, even in very large embryos. All control trials with extracts of other embryo tissues, such as kidney or liver, gave negative results. The extracts prepared from the intestines of adult pigs contained no lactase, but always afforded sucrase reactions. Suckling pigs yielded all the enzymes mentioned. In the dog there likewise appears to be a difference between the early and adult stages as regards their alimentary enzymes. Lactase was not found in either the newly hatched chick or the adult hen, while sucrase was obtained from each. The search for pepsin and rennin in the embryonic stomach yielded entirely negative results even in eleven-inch pig embryos, thus agreeing with the observations of the majority of earlier investigations.

F. P. UNDERHILL.

**The "Antitoxic" Influence of Certain Anions on the Action of Solutions of Alkaline Earth Chlorides on Ciliated Cells.**

By R. S. LILLIE. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xiii.—The destructive action of solutions of calcium chloride, barium chloride, and strontium chloride on the ciliated cells of *Mytilus* is apparently due to the preponderant action of the cation. Addition of salts with strongly acting anions were found markedly to retard this action. Thus in  $M/2$  strontium chloride the gill filaments undergo gradual coagulation; the action is prevented and movement is prolonged from a few minutes to periods ranging from ten to sixty hours by addition of small quantities of sodium hydroxide, potassium cyanide, sodium bromate or sodium hydrogen arsenate. Other anions (Br, I, CNS) proved also effective, though to a less degree. On the other hand, toxicity due to a preponderance of the anion (as in the sodium salts) is counteracted by cations.

F. P. UNDERHILL.

**A Law of Growth Reiterated.** By GRAHAM LUSK. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xvii-xviii.—This law of growth is that in the development of the normal young of the same age and species a definite percentage of the energy content of the food is retained for growth irrespective of the size of the individual.

F. P. UNDERHILL.

**A Colloidal Compound of Strychnine, and its Pharmacology.** By ORVILLE HARRY BROWN. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xxii-xxiii.—Fresh egg albumin, hydrogen dioxide



and a solution of a strychnine salt, when mixed together and allowed to stand for a month, first become milky, then viscid and finally have the appearance of a gel. The vessel containing it may be inverted without dislodging the material. The substance has a milky greenish yellow tinge. The quantity of the gel is equal to the quantity of the original solution. The gel is soluble in water, and on heating it becomes clearer. Small amounts of acid cause a precipitate, soluble in excess. The heavy metals cause a precipitate. The substance reacts to Millon's reagent and to the xanthoproteic test. It is slightly alkaline to litmus and neutral to phenolphthalein or congo red. It has been found that the presence of albumin and fat will prevent reactions for strychnine. Sugar does not. The substance was digested with acids and enzymes, but the strychnine reactions were never obtained. Two and one-half cubic centimeters of the gel injected into the lymph spaces of frogs yielded typical strychnine tetanus after five hours and in twenty-four hours the frogs were dead. In one case water was substituted for the albumin and in another for the hydrogen dioxide and the same amount of each injected into frogs gave typical strychnine tetanus in from three to five minutes and the frogs died in the course of from four to five hours.

F. P. UNDERHILL.

**The Influence of Aluminium Ions on Lupin Seedlings.** BY H. D. HOUSE AND WILLIAM J. GIES. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xix-xx.—Although aluminium compounds appear to exist in small proportions in many plants and occur in traces in some animals, relatively little has been learned regarding the biological effects and significance of aluminium. The authors have begun a series of studies in this connection, the first of which has been an investigation of the influence of aluminium on lupin seedlings. The methods described by True and Gies (1903) were used, and the following compounds were taken: aluminium sulphate, nitrate, chloride, aluminium-sodium chloride, potassium alum, and ammonium alum. In nearly all cases, in these experiments, little or no effect was produced at a concentration of M/65536. In concentrations greater than M/65536, growth usually was markedly inhibited. In concentrations less than M/65536 and down to M/1048576 or M/2097152, growth was stimulated as a rule.

F. P. UNDERHILL.

**The Comparative Toxicity for Paramoecia of the Salts of Strychnine, of Morphine, and of Quinin.** BY HARRY ORVILLE BROWN. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xxiv.—The salts of the alkaloids were dissolved in distilled water in fractional normal concentrations. Solutions of equal concentration contain the same amount of pure alkaloid. *Paramoecia* were selected for testing the toxicity of the various solutions. An example from the protocols follows: the solutions are all of

M/100 concentration. In strychnine acetate the *Paramoecia* lived thirty seconds; in the arsenate, fifteen minutes; in the bromide, eighty seconds; in the citrate, fifteen minutes; in the chloride, eighty seconds; in the glycono-phosphate, eight minutes; in the nitrate, two minutes. Similar results were obtained with both morphine and quinine.

F. P. UNDERHILL.

**On the Composition of Nasal Mucous Membrane.** BY BERT RUSSELL AND WILLIAM J. GIES. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xxiii-xxiv.—The following percentage data in general composition represent average results of analyses of tissue from many oxen:

Portion.	Water.	Solids.	Organic matter.	Inorganic matter.
Anterior .....	76.69	23.31	22.34	0.97
Median.....	78.68	21.34	20.34	1.00
Posterior.....	79.61	20.39	19.38	1.01
Longitudinal sections.	77.64	22.36	21.49	0.87
Transverse sections....	77.74	22.26	21.46	0.80

The quantity of ether-soluble material is equal to about 8 per cent. of the solid matter. Reducing substances were absent from the aqueous extracts. Neither proteolytic or amylolytic enzymes have thus far been detected. Conspicuous among the soluble proteids in the extracts is an acid-precipitable material, equal to about 2 per cent. of the fresh tissue. It appears to be nucleoprotein or a mixture containing nucleoprotein in large proportion. It does not appear to be coagulable. Preliminary tests have failed to show the presence of mucoid in the extracts. Nearly 10 per cent. of the fresh tissue is indigestible in artificial pancreatic juice, and gelatin is readily obtained from this residue. Only about 1 per cent. of the fresh tissue remains undissolved in artificial gastric juice. This residue contains nuclein.

F. P. UNDERHILL.

**A Study of Para-aeth-oxy-phenyl Camphoryl-imide (Camphenal) as an Antipyretic.** BY E. M. HOUGHTON. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xxvi-xxvii.—When administered internally to dogs (normal) in large quantities it produces practically no influence upon the temperature, while acetphenetidine shows an irregular but usually a considerable antipyretic action. A number of dogs suffering from "dog distemper" whose temperature was abnormally high were treated with camphenal without showing any marked antipyretic action. Several dogs were given diphtheria toxin which possesses the property of producing an increased temperature. Camphenal in each case produced a slight, if any, fall in temperature and much less marked than in the case of acetphenetidine or acetanilide. These experiments are of interest in that they show that the camphoryl group

cannot take the place of the acetyl group in acetphenetidine without the loss of the antipyretic property.

F. P. UNDERHILL.

**Further Observations on the Action of Lipase.** BY A. S. LOEVENHART. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xxvii-xxviii.—The experiments indicate that the enzyme which acts on the higher fats, and which is properly called lipase, is probably different from that which acts on the esters.

F. P. UNDERHILL.

**Observations on the Survival-respiration of Curarized and Non-curarized Muscle.** BY G. T. KEMP AND E. R. HAYHURST. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xxviii-xxix.—The results given below were all obtained from muscles supplied with abundant oxygen (5 to 8 liters per hour of air free from carbon dioxide) at a negative pressure of 25 mm. mercury. Isolated frog and mammalian muscle, at rest, produces carbon dioxide constantly. The amount is greatest immediately after excision. The curve for the yield of carbon dioxide from frog's muscle shows marked irregularities, but nearly always there is an increased yield at the third and at the fourth hour. After the seventh hour the yield becomes nearly constant until putrefaction sets in, when there is a sudden and enormous increase. With mammalian muscle (cat and dog) the curve is much more regular. Contracting muscles (frog), not fatigued, and lying free so as not to perform work, do not as a rule, give off more carbon dioxide than when at rest. If the muscle is made to work, the carbon dioxide is increased. There appears to be no difference in the yield of carbon dioxide from a muscle when stimulated through its nerve and when stimulated directly. A temperature between 18° and 30° C. does not appear to affect the yield of carbon dioxide. Variations in the speed of the air current from 5 to 8 liters per hour do not affect the yield of carbon dioxide. When the current is shut off the absolute yield is greatly reduced. Curare has no influence on the production of carbon dioxide in the unstimulated muscles of the frog. Curarized frog's muscles, when their nerves were stimulated, have not given constant results. Curarized mammalian muscles (dog and cat) when their nerves are stimulated, give off more carbon dioxide than when at rest.

F. P. UNDERHILL.

**The Mechanism of Salt Glycosuria.** BY FRANK P. UNDERHILL AND OLIVER E. CLOSSON. *Proc. Am. Physiol. Soc., Am. J. Physiol.* **15**, xx-xxi.—When sodium chloride is injected into the venous circulation of the rabbit, polyuria and glycosuria are in evidence, probably as a result of the increased permeability of the kidney. The permeability of the kidney may be decreased by injection of a mixture of sodium chloride and calcium chloride,



as is indicated by the temporarily decreased flow of urine and diminished or inhibited excretion of sugar. Further evidence that this form of glycosuria is of renal origin is furnished by the observation that during the appearance of sugar in the urine hypoglycaemia is noted, whereas the sugar content of the blood becomes normal, or hyperglycaemia obtains, when the excretion of sugar in the urine has been inhibited by injections of a mixture of sodium chloride and calcium chloride. Injections of sodium chloride into the cerebral arterial circulation produce glycosuria with no polyuria but with an accompanying hyperglycaemia. The increased sugar content of the blood may be referred to disturbances of respiration, dyspnoea, induced by injection of sodium chloride. The mechanism controlling the glycosuria provoked by the introduction of sodium chloride into the circulation of the rabbit, therefore, varies with the manner of injection. Injections of magnesium sulphate into the ear vein of the rabbit cause the appearance of sugar in the urine without an accompanying polyuria. The mechanism involved may be attributed to the dyspnoea induced.

F. P. UNDERHILL.

**Physiological and Pharmacological Studies of Magnesium Salts.—II. The Toxicity of Intravenous Injections; in Particular the Effects upon the Centers of the Medulla Oblongata.** BY S. J. MELTZER AND JOHN AUER. *Am. J. Physiol.* **15**, 387-406. —Magnesium salts in intravenous injections are very toxic, even in small doses. The first effect is upon respiration, which becomes completely inhibited. The respiratory center is deprived of its responsiveness to asphyxiated blood, and the reflex effect of sensory stimuli is greatly reduced. Magnesium salts favor the inhibitory effects of the respiratory fibres of the vagus. Prolonged artificial respiration restores earlier or later the respiratory function. Repetition of injections within a comparatively short time increases the susceptibility of the animal to the toxic effect. Large doses of the salt injected with rapid speed affect also the tonus of the vaso-motor center. During the toxic effect upon the vaso-motor mechanism, the vaso-constrictor effect of sensory stimuli is distinctly reduced, but not the effect of the stimulation of the depressor nerve. On the contrary, the vaso-inhibitory effect of that nerve is apparently rather increased. Magnesium salts inhibit also the activity of the center of deglutition. During the complete inhibition of respiration by the intravenous injection of magnesium salts the animal is in a state of deep, general anaesthesia, with complete relaxation of all muscles. An animal might stand very slow injections of a very dilute solution of magnesium salts without harm. In these experiments 1 gram of magnesium sulphate per kilo of animal injected within one hour produced no perceptible harmful effects. This is important for the explanation of the apparent harmlessness of the administra-

tion of magnesium sulphate by mouth. The absorption from the gastro-intestinal canal is perhaps so slow as not to introduce into the circulation more than the above-mentioned innocuous dose.

F. P. UNDERHILL.

**A Study of the Absorption and Consumption of Oxygen in Heart Tissue.** BY E. G. MARTIN. *Am. J. Physiol.* **15**, 303-321. —Fresh ventricular strips, immersed in oxygen-free sodium chloride solution, give series of contractions which are characterized by their comparatively short duration. The assumption is made that under these conditions the tissue draws wholly upon the oxygen in solution in its juices to obtain the amount necessary for its activity. The arrest which ends the series is supposed to be due to asphyxia resulting from exhaustion of the oxygen supply. It is characterized by the ease with which oxygenation induces recovery, and by the fact that addition of a calcium salt is without effect. Exhaustion in a saline bath having in solution a moderate amount of oxygen is assumed to be due, not to lack of oxygen, but to the fact that the ability of the tissue to absorb it has diminished to such a degree that it can no longer do so at the low concentration at which the oxygen is present in the solution. The very long series of beats which occur in sodium chloride solution kept saturated with oxygen, show that the tissue possesses the power to take up oxygen from the surrounding medium, provided it is present therein in sufficient concentration. The excellent recovery which follows the addition of a small proportion of a calcium salt to an oxygen-containing solution in which exhaustion has occurred, indicates that the ability of the tissue to absorb oxygen from the surrounding medium is dependent upon the presence within it of calcium ions. It is assumed that the chief function of calcium is to promote oxygen absorption. Whenever a strip is placed in an alkaline medium under such conditions that it becomes responsive to the alkali influence, a very typical series of contractions is given in which the total energy output of the tissue seems to bear a definite relation to its mass. This energy liberation is entirely independent of the supply of external oxygen. It is suggested that the effect of the alkali is to decompose some oxygen-containing compound in the tissue, thereby rendering available a certain definite store of oxygen which is not affected by other modes of treatment.

F. P. UNDERHILL.

**The Mechanism of Salt Glycosuria.** BY FRANK P. UNDERHILL AND OLIVER E. CLOSSON. *Am. J. Physiol.* **15**, 321-333. —For abstract of this article see this Review, also *Am. J. Physiol.* **15**. *Proc. Am. Physiol. Soc.*, December, 1905.

F. P. UNDERHILL.

**Osmotic Pressure and Heart Activity.** BY A. J. CARLSON.

*Am. J. Physiol.* **15**, 357-371.—These experiments on the heart of *Limulus* brought out the fact that hypertonicity of the medium depresses the rhythm primarily, while hypotonicity acts as a primary stimulus to the rhythm. These are also the effects of hypertonicity and hypotonicity of the medium in the case of the tortoise auricles. In *Limulus* these effects of hypertonicity and hypotonicity are true both for the heart ganglion and the heart muscle.

F. P. UNDERHILL.

**The Proportion of Glutaminic Acid Yielded by Various Vegetable Proteins when Decomposed by Boiling with Hydrochloric Acid.** BY THOMAS B. OSBORNE AND RALPH D. GILBERT. *Am. J. Physiol.* **15**, 333-357.—The following table gives a summary of the results obtained:

#### VEGETABLE PROTEINS.

Glutamic acid in per cent.

##### *Cereals—Proteins soluble in alcohol:*

Gliadin, wheat .....	37.17
Gliadin, rye.....	33.81
Hordein, barley.....	36.35
Zein, maize .....	16.87

##### *Proteins soluble in water:*

Leucosin, wheat.....	5.72
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##### *Proteins soluble in alkali:*

Glutenin .....	23.42
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##### *Legumes—Proteins soluble in saline solutions:*

Phaseolin, kidney bean.....	12.33
Legumin, vetch .....	16.48
Vignin, cow pea.....	16.89
Glycinin, yellow soy bean .....	19.46
Glycinin, Japanese soy bean .....	17.92
Conglutin, A, yellow lupine.....	20.96
Conglutin, B, yellow lupine.....	30.05
Conglutin, C, blue lupine.....	23.00

##### *Oil seeds—Proteins soluble in saline solutions:*

Amandin, almonds.....	23.14
Globulin, sunflower .....	21.79
Corylin, hazel nut.....	17.94
Globulin, castor bean.....	14.50
Excelsin, Brazil nut.....	12.94
Globulin, cottonseed .....	17.59
Globulin, squash seed .....	12.35
Edestin, hemp seed.....	14.00

#### ANIMAL PROTEINS.

Casein, cow's milk .....	10.77
Ovalbumin, hen's egg .....	9.01
Conalbumin, hen's egg .....	7.00

F. P. UNDERHILL.



**The Inversion of Starch by Platinum Black.** By C. HUGH NEILSON. *Am. J. Physiol.* **15**, 412-416.—It is shown that platinum black has the power of transforming starch into decomposition products probably identical with those formed from starch by ptyalin. The process in the former case is, however, very slow when compared with the action of ptyalin.

F. P. UNDERHILL.

**On the Respiration of the Heart.** (With special reference to the heart of *Limulus*.) By H. H. NEWMAN. *Am. J. Physiol.* **15**, 371-387.—The heart ganglion is comparatively indifferent to lack of oxygen, retaining its activity unimpaired when deprived of oxygen for several hours. Hydrogen exercises a favorable influence on the heart rhythm. The heart ganglion is very sensitive to carbon dioxide, showing a primary stimulation followed by a quick fall to diastolic standstill. The recovery of the heart ganglion after carbon dioxide paralysis is rapid and may be repeated many times. The heart muscle is very much less sensitive to carbon dioxide than is the ganglion; the heart ganglion of *Limulus* is much more resistant to lack of oxygen than is the central nervous system. Asphyxia is believed to be due to an accumulation of carbon dioxide produced by the cellular activity of both muscular and ganglionic elements of the heart, but affecting chiefly the ganglionic element.

F. P. UNDERHILL.

**The Adaptation of the Salivary Secretion to Diet.** By C. HUGH NEILSON AND OLIVER P. TERRY. *Am. J. Physiol.* **15**, 406-412.—It is shown that dogs fed on a bread diet or a mixed diet develop a salivary secretion possessing amylolytic power to a much greater degree than that of dogs kept upon a meat diet.

F. P. UNDERHILL.

**The Fatigue of Cold-blooded Compared with that of Warm-blooded Muscle.** By FREDERIC S. LEE. *J. Am. Med. Assn.* **45**, 1776-1777.—The conclusions drawn are that there is a physiologic difference between cold-blooded and warm-blooded animals in the mode of fatigue of their excised voluntary muscles. One of the characteristic phenomena of fatigue of the excised voluntary muscles of cold-blooded animals is a pronounced showing of the whole contraction process manifested by a lengthening of the muscle curve. This is most pronounced at low temperatures. It is diminished, but not obliterated at high temperatures. The excised voluntary muscles of most warm-blooded animals fatigue without a slowing of the contraction process as a whole. At low temperatures there is observable a broadening of the muscle curve, caused by fatigue, which, in individual cases, may result in a minute lengthening of the curve as a whole. The above facts suggest that the general physiologic differences be-

tween the muscles of cold-blooded and warm-blooded animals are not due to immediate differences of temperature. The existence of a homothermal condition and the constant subjection of the skeletal muscle system to a uniform temperature, seem to impress on that system distinctive physiologic peculiarities.

F. P. UNDERHILL.

**Are the Proteolytic and Milk-coagulating Effects of Gastric and Pancreatic Juice Due to One and the Same Enzyme?** By JOHN C. HEMMETER. *J. Am. Med. Assn.* **45**, 1771-1775.—A review of the work of Pawlow and Parastschuk who claim that the proteolytic and milk-curdling effects of gastric and pancreatic juice are due to one and the same enzyme in which the author differs from the work quoted. Some typical experiments are given.

F. P. UNDERHILL.

**Minimal Albumin Requirements in Health and Disease.** By L. BREISACHER. *J. Am. Med. Assn.* **45**, 1775-1776.—The author shows that while experiments on minimal albumin quantities prove that the average individual may and usually does eat too much albumin, and while probably 60-80 grams of albumin are nearer the normal requirement than the 118 grams of Voit, one should bear in mind that individual cases may require even much larger quantities of albumin than those called for in the Voit formula.

F. P. UNDERHILL.

## PHARMACÉUTICAL CHEMISTRY.

**A Critical Review of the Inorganic Chemistry of the United States Pharmacopoeia.** By HENRY W. SCHIMPF. *Am. J. Pharm.* **77**, 513 (1905).—This is the first of a series of articles on the U. S. P. The author first gives a list of the chemicals that have been added to the pharmacopoeia and then takes up each article and gives the pharmacopoeial requirements, and follows with comments. In general these are favorable to the work of the committee. He calls attention to the fact that a mixture of clay and glycerol similar to *cataplasma kaolini* has long been employed as a household remedy in Central Europe. The addition of ammonium salicylate is considered as unnecessary. He approves of the addition of the exsiccated sodium arsenate, as it is more stable than the sodium arsenate from which it is prepared, but the retention of the latter is thought to be a mistake, as dangerous results are liable to occur from confusion. In the second article, *Am. J. Pharm.* **77**, 551, Mr. Schimpf considers the inorganic substances that have been dismissed from the U. S. P. Here, also, in most cases he agrees with the work of the committee, but thinks it a mistake to have dropped *ferri valerianas*, *hydrargyri subsulphas flavus*, *potassa sulphurata*, *sodii*

*carbonas* and *zinci phosphidum*. The author thinks it unfortunate that the committee did not adopt the spelling of the A. A. A. S. for chemical terms, except in the case of alkaloids where he considers it advisable to retain the final *e* to avoid confusion with glucosides, which end with *in*. In the third paper of the series, *Am. J. Pharm.* **78**, 18 (1906), the author considers some of the inorganic acids and salts. He reviews some of the assay methods for these, as, for boric acid, sulphurous acid, reduced iron, solution of lead subacetate, etc. In the assay of sodium nitrite the gasometric method of the old pharmacopoeia is replaced by a volumetric method, depending upon the oxidation of the nitrite to nitrate by the action of potassium permanganate.

A. B. STEVENS.

**Progress of Pharmacy.** BY M. I. WILBERT. *Am. J. Pharm.* **77**, 583 (1905).—This is said to be a quarterly review of some of the literature pertaining to pharmacy, and is largely in the nature of abstracts from other journals, from which the following are taken: The seventh revision of the Spanish Pharmacopoeia was published under date of June 20, 1905.

The work of the Council on Pharmacy and Chemistry of the American Medical Association is said to be decreasing the sale of so-called "ethical" nostrums, and is receiving the approval of medical men and medical societies.

*Liquor License.*—From December 1, 1905, compounds containing alcohol without medicinal substances readily detected by chemical analysis, will be classed as liquors, and druggists who handle them will be required to pay the regular liquor dealer's license. He calls attention to the fact that complications may arise in local option, and high-license localities.

"*Two New Aconitines.*"—The Imperial Institute reports the isolation of Indaconitine from *Aconitum napellus* var. *hians*, and Bikhaconitine from *Aconitum ferox* var. *spicatum*. The former is said to be less active than the latter. From *Chem. and Drug.* p. 278, 1905.

"*Manipulated Opium.*"—*Jour. pharm. chim.* p. 529, 1905, reports five samples of opium which were guaranteed to contain 10 per cent. of morphine; and were found to contain the full amount, but had the appearance of having been made from extracted opium by the addition of morphine.

*Alypin.*—A crystalline, non-hygroscopic substance, is said to be a new and powerful local anesthetic. It is used in a 4 or 5 per cent. solution. From *Apoth. Ztg.* p. 586, 1905.

Several other new chemicals are also reported as, iothion, diiodohydroxypropane, for internal administration in place of iodine. Sanoform, methyldiiodosalicylate, a colorless substitute for iodoform.

A. B. STEVENS.



**Chairman's Address on Education and Legislation.** BY HARRY B. MASON, before the American Pharmaceutical Association at Atlantic City, September 4, 1905.—The author reviews pharmaceutical legislation, from which we learn that New York, Pennsylvania and Wisconsin have a graduate requirement law. A number of states and territories have increased their requirements, especially in regard to preliminary education, and some have made more stringent rulings in regard to credits from colleges of pharmacy. Out of over eighty schools or colleges of pharmacy, New York, Ohio and Pennsylvania have only recognized 16, 17 and 21 respectively. A number of colleges of pharmacy have increased their entrance requirements. Mr. Mason makes a strong plea for higher education and urges that prerequisite laws should demand of all colleges, whose diplomas they recognize, an entrance requirement of at least a year of high school work. This has already been done by several states.

A. B. STEVENS.

**The Evolution of Chemical Materia Medica.** BY M. I. WILBERT. *Am. J. Pharm.* **77**, 473 and 542 (1905).—This is part of an address by Dr. Friedrich Sparling on "The Materia Medica, Once and Now," delivered before the Austrian Pharmaceutical Association of Vienna, *Pharmaceutische Post*, p. 175, 1905. Among the substances known to the ancients he gives sulphur, ammonium chloride, potassium carbonate, sodium carbonate, gypsum, lead carbonate and oxide, iron sulphate, mercury, gold, copper, etc. Among the substances introduced by the Arabians are, potassium nitrate, hydrochloric acid, nitric acid, mercurous chloride and oxide, nitrate of silver, lead acetate, alcohol, camphor, and ammonia. Then follows a list of the substances discovered during each of the centuries. In many cases the date and the name of the discoverer are given.

A. B. STEVENS.

**Inorganic Chemistry of the Pharmacopoeia.** BY H. V. ARNY, PH. D. *Am. J. Pharm.* **78**, 10 (1906).—The author approves of the "Purity Rubric" as a safeguard to the pharmacist. Among the additions he approves of compound solution of chlorine, compound solution of sodium phosphate, compound syrup of hypophosphites and effervescent sodium phosphate, but does not consider the substitution of effervescent magnesium sulphate for the citrate, an improvement. Among the large list of omissions he takes exception to the dropping of sulphurated antimony and solution of ferric citrate. The author approves of the reduction of chemical formulas of the following: Alum, ferric alum, ferric hydrate, ferric chloride, mercurous chloride, and mercurous oxide.  $K_2Al_2(SO_4)_4 \cdot 24H_2O$ , becomes  $KAl(SO_4)_2 \cdot 12H_2O$ , etc. The author, as well as some other critics, objects to the use of the names sodium hydroxide, potassium hydroxide, calcium oxide

and magnesium oxide for soda, potassa, lime and magnesia. (As soda is used in German for sodium carbonate and is often used popularly in America for sodium bicarbonate the use of the word to designate sodium hydroxide seems objectionable.—EDITOR.)

A. B. STEVENS.

**Nascent Silver Iodide.** BY M. I. WILBERT. *Am. J. Pharm.* 78, 64 (1906).—After referring to the use of silver iodide as a local antiseptic in urethritis, the author calls attention to the fact that it is insoluble, but that it is decomposed by reducing agents into its constituents, which are active antiseptics, and states that the activity varies with the age and fineness of the precipitate, and that the nascent silver iodide is most active in the form of an emulsion which should be freshly prepared and kept in a dark place. The formula for a 3 per cent. silver iodide emulsion, as used in the German Hospital, Philadelphia, is as follows: Silver nitrate, 2.2 grams; potassium iodide, 2.2 grams; distilled water, 50 cc.; mucilage of Irish moss, N. F. to make 100 cc. The activity of the resulting emulsion depends upon the method of compounding. "For a heavy, coarse precipitate, the potassium iodide and the silver nitrate are dissolved separately, each in 5 cc. of distilled water, and mixed. The remainder of the water and the mucilage are then added. For a more active, light flocculent precipitate the salts are dissolved separately, each in 50 cc. of water, then thoroughly mixed and allowed to settle until 50 cc. of supernatant liquid can be decanted, which is replaced by sufficient mucilage to make 100 cc."

A. B. STEVENS.

**The U. S. Pharmacopoeia from the View-point of the Analyst and as a Legal Standard.** BY HENRY LEFFMANN. *Am. J. Pharm.* 78, 77 (1906).—The author objects to giving the chemical formulas and to the making of the Pharmacopoeia a work of reference in chemistry, and states that "by elimination of irrelevant matter the book might have been reduced one-third." He seems to think that it should have represented all schools of medicine, and that the list of reagents and their strength when used as test solutions are unnecessary. The use of the hydrogen system of atomic weights and the introduction of structural formulas are strongly condemned. Many pharmacopoeial names are criticized. The author states that the "Pharmacopoeia devotes much attention to analytical methods, yet it is but little used by those in general analytical practice," also that it should be more frequently revised and that "Two years, or at most three years is the efficient life of an analytical manual." The author would exclude all solvents and materials used as tests or for the preparation of other remedies. He criticizes at length the tests for the purity of water. The author's opinion of the U. S. P. is

perhaps best expressed in his own words. "If I regard the Pharmacopoeia in its present form as unsatisfactory to the analyst, it is in still a more unfavorable light that I regard it as a legal standard."

A. B. STEVENS.

**A Simple Arrangement for Percolation with Hot Alcohol.**

BY H. M. GORDIN. *Am. J. Pharm.* **77**, 463 (1905). Presented at the meeting of the American Pharmaceutical Association, 1905.—"The arrangement consists in rolling a coil of rubber tubing around the percolator and passing a stream of hot water through the tubing during percolation."

A. B. STEVENS.

**A Combination Percolator and Shaking Tube for the Assay of Alkaloidal Drugs.**

BY H. M. GORDIN. *Am. J. Pharm.* **77**, 463 (1905). Presented at the meeting of the American Pharmaceutical Association, 1905.—This apparatus is intended to prevent the necessity of transferring the drug and solvent from a flask to a percolator, in cases where it is necessary to agitate the mixture for some time before starting percolation. It consists of a tube 25 mm. inner diameter, contracted at one end into a bottle-shaped neck, 17 mm. in diameter. The other end, 200 mm. from the neck, is drawn out into a tube 30 mm. long and 14 mm. in diameter. Three indentations are made in the smaller tube where it joins the larger. To use the apparatus, a piece of cotton is enclosed in a small piece of cheese-cloth and pushed into the small tube until it reaches the indentations, and more cotton added until the tube is nearly filled. It is then closed with a perforated cork, containing a glass stop-cock. The drug and menstruum are then placed in the percolator and the latter closed with a cork. After shaking the required length of time the percolator is placed in an upright position, and when the residue has settled, percolation is finished as usual.

A. B. STEVENS.

**Manufacture of Pharmaceutical Preparations.**

BY A. C. ZEIG, PH. C. *Am. J. Pharm.* **77**, 465 (1905).—This article is very interesting and must be read to be appreciated. However, it contains nothing new to science. It is principally a history of the manufacture of pharmaceuticals from 1150 A. D. to the present time, from the old electuary to the new synthetics. In speaking of the popularity of fluid extracts he states that in 1904 about 1,500,000 pounds of cascara bark were shipped from the Pacific coast and most of it was used in the manufacture of the fluid extract. The author denounces the practice of some manufacturers, who place on the market, under official names, preparations which have not been made according to pharmacopoeial standards.

A. B. STEVENS.

**Japanese Lac.**

BY A. B. STEVENS. *Am. J. Pharm.* **78**, 53 (1906).—Japanese lac, a natural product of *Rhus vernicifera*, occurs as



an emulsion containing gum, diastatic matter, resinous substances, water and acetic acid. The lac is treated with strong alcohol, filtered, and evaporated. The resinous substances remain as a dark, red-brown, oily liquid, which contains a poisonous, non-volatile substance or substances. Attempts to separate the resinous substances into two or more constituents by fractional precipitation with alcoholic solution of lead acetate and of basic lead acetate were not successful. Better results were obtained with petroleum benzine by means of which two portions were obtained, the benzine-soluble one only, being poisonous. The benzine-insoluble part could be further separated into three portions by treating with methyl alcohol and ether. By agitating the benzine-soluble portion with ethyl alcohol and petroleum benzine in immiscible proportions the poisonous principle remained in the alcoholic layer on separation. The alcoholic layer yielded a slightly gelatinous residue on evaporation. An oily, non-poisonous, brown residue was left on evaporating the benzine layer. These fractions in alcoholic solution all gave black precipitates with soluble salts of mercury, silver, copper and iron. Lead acetate gave a gray precipitate, which become darker on standing. By oxidation all the resinous substances yield a black, insoluble substance which the author names oxyurushine and to which he ascribes the formula,  $C_{102}H_{138}N_2O_{19}$ . From the alcoholic insoluble portion of the lac an active gum enzyme was obtained by solution in water and precipitation with alcohol. This gum enzyme contained nitrogen, yielded mucic, oxalic and tartaric acids on oxidation, and produced a non-fermentable non-crystallizable, dextrorotatory, reducing sugar on hydrolysis with dilute sulphuric acid. The phenylhydrazine derivative of this sugar melted at  $162-164^\circ$ , corresponding to phenylsorbinosazone. The poisonous principle of Japanese lac causes symptoms similar in all respects to those from ivy and sumac. L. E. WARREN.

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## INDUSTRIAL CHEMISTRY.

### Vertical Retorts for Producing Coal Gas and Water Gas.

*Am. Gas Light J.* January 22, 1906.—The article refers to a French patent of M. Rummens, which provides for a means of retorting coal. After the coking and the passing off of the gas, the coke is dropped into a lower chamber, where water is allowed to enter through an injector, running up through the center of this chamber, and continually supplying water to the coke, which, because of its high heat, converts it at once into steam. This then combines with the hot coke to form water gas, which mixes with the coal gas. The operation consists of three different periods of distillations: (1) A period during which, until a temperature between  $800^\circ$  and  $900^\circ$  has been reached, only coal gas

of good quality will be produced. (2) A period during which, by maintaining the temperature in the retort above  $700^{\circ}$ , by superheating that by means of generators, and by suitably regulating the injection of water, there will be produced, once or several times, a highly economical mixture of coal gas and water gas of good quality. (3) A period during which, by carbonizing coal at a high temperature, that is, from  $700^{\circ}$  to  $1200^{\circ}$ , a large quantity of coal gas will be obtained, but of lower quality than that produced during the first period. The coke is dropped from the upper to the lower retort by means of sliding bottoms.

S. P. SADTLER.

**Ten Years of Electric Reduction at Niagara Falls.** *Electrochem. Metal. Ind.* January, 1905.—The extent of the work now being carried out at Niagara Falls is dwelt upon. There are now produced from the electric furnace at Niagara Falls, artificial graphite, siloxicon, silicon, carborundum, alundum (fused alumina), calcium carbide, phosphorus and ferro-alloys. By electrolysis of fused electrolytes, aluminum, sodium, caustic soda and chlorine are produced. The last two products and caustic potash, hydrochloric acid and chlorates are made by processes using aqueous electrolytes. Ozone is also made and used in the manufacture of vanillin. Experiments are, furthermore, being carried out with the Townsend diaphragm cell, and the Ruthenberg process on the production of iron from magnetic concentrates, etc.

S. P. SADTLER.

**The Production of Bromine in 1904.** *J. Franklin Inst.* January, 1906.—American bromine is obtained chiefly from brines in Michigan and several other places in the United States. The bromine is obtained from the residual liquors, or bitters from salt manufacture. After treatment with sulphuric acid, bromine is obtained from the hydrobromic acid thus formed, and separated by means of oxidation of the hydrogen to form water, which is effected either with chlorate of potash or manganese dioxide. During 1904 the total output was 897,100 pounds, valued at \$269,130.

S. P. SADTLER.

**Labor-saving Appliances in the Laboratory.** BY EDWARD KELLER, Baltimore, Md. *J. Franklin Inst.* February, 1906.—The most noteworthy devices suggested by, and used in the laboratory of the author, are stirring and filtering apparatus, in which beakers of uniform size are held in frames, where, by means of small pulleys, to which small stirring rods are attached, they can be stirred and then placed in frames in another form of apparatus, where they can be poured over small funnels, the stirring rods being held securely upon the beakers for directing the flow of the liquid, as is usually done in hand filtration. The support of the beakers and stirring rods is gradually raised and turned,

so that the solutions from all beakers are filtered with the same rapidity and held at any point for emptying or washing with a substitute for the wash-bottle about to be mentioned. Instead of the use of a wash-bottle, the author suggests that the distilled water be held in carboys raised  $4\frac{1}{2}$  feet from the level of the floor and carried by means of siphons from these carboys to glass tubes running along the work tables. To these are attached flexible tubing and glass nipples. With regard to the saving in time in filtration, the author figures out that where sixty-four minutes were consumed in filtering 20 beakers individually, 38 were required by means of the apparatus employed, with the saving of twenty-six minutes. Another device is that of a machine for rotating the beaker, with a cork on the end of a rod, to which filter-paper is clamped. This is called a "policeman" and rubs off any particles that are not readily removed otherwise, the filter-paper being put into the crucible for ignition. Various new furnace assay tools are described and shown in cuts, including multiple tongs for pouring scorifiers. S. P. SADTLER.

**Tests for Paints.** BY JEAN ROBERT MOECHEL, PH.D. *Chem. Eng.* December, 1905.—All paints contain pigment and vehicle, generally with a diluent and frequently a drier.

The object of painting is to preserve and cover. The vehicle acts as a preservative for holding the pigment together, and may consist of glue, gum, rosin, resin, starch, liquid glass, blood, cheese, linseed oil (raw and boiled), also varnish.

If the vehicle is water-soluble, such as most of those mentioned, the paint will have a short life. The drier used is generally manganese dioxide. The diluent may be turpentine, alcohol, gasoline, kerosene, wood alcohol, water, potash and soda. Only turpentine and alcohol are considered as desirable. Only a chemical examination will show the composition of a paint.

The different agencies which a paint should resist, and the tests to be applied, are given at length. The paint is spread on plates of glass, wood, tin sheeting, galvanized iron, sheet steel, etc., cut 1 by 3 inches or 2 by 5 inches. Eight days are allowed to elapse after painting.

Samples are immersed for twenty-four hours in 10 per cent. and 25 per cent. solutions of hydrochloric, nitric and sulphuric acids. A repetition is then made of heating for two hours in a water-bath.

Fumes of hydrochloric, nitric and sulphuric acids are allowed to play upon the paint for three minutes. The articles are dipped in 10 and 25 per cent. solutions of caustic soda. The vapors from strong ammonia are blown over the plates for five minutes.

The action of sulphurous acid, hydrogen sulphide, steam, both at normal pressure and ordinary boiler pressure, are applied for about thirty minutes. For the first two, one hour is required for



steam under pressure and twelve hours for steam at ordinary pressure. With steam at ordinary pressure the sample should not be affected.

The spreading capacity is found by measuring the amount of paint used. This is done by weighing the plates before and after painting, and finding the amount necessary to cover satisfactorily. The time of drying is found and should be between twelve to eighteen hours.

The elasticity is a point that is gone into in detail, and is determined by painting strips of tin which are coated with the paints and should resist bending when dry.

Penetration of the paint into wood is determined by using white pine wood strips,  $1\frac{1}{2} \times 4\frac{1}{2}$  inches. After painting, the strips are cut crosswise and lengthwise and examined with a magnifying glass for penetration.

Another important test is to determine the absorption of water. Wood, stone, brick and concrete are tested by making into cubes of about 1 to  $1\frac{1}{2}$  inches. The blocks are put in a water-oven for three hours. After cooling, one, two or three coats of paint are used, allowing each to dry thoroughly, and after the final coat, dried for eight days. Weigh the blocks and put the thoroughly dry ones into distilled water and put on to boil, wipe dry with blotting-paper and weigh the blocks. Increase in weight is due to absorption of water.

The adhesion of paint to the surface is obtained by a vacuum produced in a funnel with a rubber rim.

The fineness of the pigment is determined as follows: Use two plates of glass  $2 \times 5$  inches. Mix the paint thoroughly, place a small amount of paint upon the glass and press down with the other. Now stand both glasses up and allow the paint to run. After one hour examine the paint; no separation of the pigment particles should appear for at least an inch of downward surface.

Color comparisons are obtained by dropping the two paints on a microscope slide and bringing them together by pressing down a cover glass, so that the two surfaces touch. They can then be compared from white or black surfaces.

Heat tests are applied by heating in ovens to  $100^{\circ}$ ,  $300^{\circ}$  and  $500^{\circ}$ . In some cases paints are supposed to protect from fire, and the degree of protection can be somewhat determined by testing painted and unpainted wood with the open flame.

S. P. SADTLER.

**The Elements of Chemical Engineering. I. Materials of Construction.** *Chem. Eng.* January, 1906.—When wood is to be placed near heated surfaces, it should be well seasoned, for obvious reasons. Pitch pine is probably the most suitable kind of wood to be used where there is exposure to fumes, because of the pro-

tecting action of the rosin. Cypress wood is best for tanks, due to its smaller degree of shrinkage and expansion, its straight grain and the small amount of color and odor that it imparts to solutions.

A table giving the weights per cubic foot in pounds, tensile strength, crushing strength, cross-section and shearing strengths of most of the woods, is given.

*Cast Iron, Wrought Iron and Steel.*—Although iron is acted upon by most acids, it is largely used for making vessels in chemical plants because of its cheapness. Cast iron is not so readily attacked by acids as wrought iron, and stands sulphides and alkalis at high temperatures very well. Sulphuric acid may be kept in wrought iron tanks, if the gravity does not go below 1.7, and it is kept cool. The more concentrated acid can be kept in, and even boiled in cast iron vessels.

The resistance of steel to corrosion by acids is said to increase with the percentage of combined carbon. To investigate the action of the various substances upon metals, weighed bright strips of the same are put into the solutions at the temperatures desired, and finally removed, cleaned, dried and weighed. The loss in weight will show the corrosion.

*Copper.*—This is usually employed for stills, condensers and digestors, because of its heat-conducting properties, its malleability and tenacity. The chief reagent to be avoided is ammonia and its fumes, and the fumes of mineral acids. Mineral acids, such as nitric, sulphuric and hydrochloric attack copper, but the weaker organic acids have little or no effect upon it. Gun-metal and manganese bronze are important alloys of copper, which stand dilute sulphuric acid and are used for making acid pumps, etc.

*Lead* is of low tensile strength, and soft, but much used because of its resistance to corrosion by acids and its ductility. Lead is little acted upon by sulphuric acid of less than 1.7 specific gravity. It is used for sulphuric acid chambers and denitrators, and also for pans used in concentrating, until the gravity gets up to 1.7, when cast iron is used.

Joints in lead are made by "burning", which consists in fusing the surfaces together with a hydrogen blowpipe. Where there is much pressure upon the apparatus, lead is covered on the exterior with wood or steel. Lead piping is much used in chemical works, but must be protected from mechanical injury.

*Tin* is much used for condenser worms and lining copper.

*Aluminum* has similar properties to copper in resisting weak organic acids. Cast aluminum stills are now used with worms of aluminum tubing in acetic acid factories.

A useful table is given, stating the specific gravity, melting-point, electrical conductivity, heat conductivity, tensile strength,

weight per cubic inch in pounds, weight per cubic foot in pounds. An approximate price per pound of the most important metals is given.

**Stone.**—Stone is much used for resistance of acids in cisterns and stills, especially in the case of hydrochloric acid, although iron covered with acid-proof porcelain is much used. The kind of stone used is generally of great density, such as slate.

S. P. SADTLER.

**Softening Water with Barium Carbonate.** *Chem. Eng.* January, 1906.—The action of barium carbonate is to react with calcium sulphate by precipitating calcium carbonate and forming barium sulphate, being in this way an improvement upon alkaline carbonates which form soluble sulphates. These tend to creep through joints and render boilers leaky. Because of its insolubility in water, barium carbonate acts slowly.

S. P. SADTLER.

**Sand Lime Brick.** BY E. W. LAZELL. *Trans. Eng. Club, Philadelphia*, January, 1906.—They are divided into two classes.

(A) Those in which the hardening is due entirely to the formation of calcium carbonate.

(1) Made from lime, and allowed to harden in the atmosphere.

(2) Those in which this setting is accelerated by an atmosphere rich in carbon dioxide.

(3) The same as (2) with the addition of pressure.

(B) Those hardened by steam—silico-calcareous.

(1) Hardened by steam under normal pressure.

(2) Hardened by steam under high pressure. The last method forms the basis of the present paper. Some claim that hydro-silicates form from the sand in this case but this has not been demonstrated.

The claims made for these bricks are: (1) They improve with age; (2) uniform size, shape and color; (3) uniform and high compressive strength; (4) uniform and high tensile strength; (5) low porosity; (6) no efflorescence; (7) unaffected by atmospheric changes; (8) no disintegration by freezing; (9) great resistance to the action of fire; (10) poor conductors of heat and electricity.

S. P. SADTLER.

**The Simplex System of Concrete Piling.** BY CONSTANTINE SHUMAN. *Trans. Eng. Club, Philadelphia*, October, 1905.—The system consists in having steel "alligator" jaws, forming a hollow point when closed, which have a sleeve to which they are hinged; this in turn is cut away to form a seat for the long hollow cylinder which forms the body of the steel driving pile. This has the same internal diameter as the sleeve, but is of  $1\frac{1}{2}$ -inch material, while the sleeve and jaws are of  $1\frac{1}{2}$ -inches. When the cylinder has:



been driven far enough down, the cylinder is lifted, which allows the jaws to fall apart and then concrete is driven down as the cylinder and jaws are lifted, finally forming a true, compact concrete pile.

The steel jaws will pierce any hard top soil and turn aside moderate sized boulders. The concrete, furthermore, forms bonds with these boulders, which generally anchor it effectually by the projections which they form.

There seem to be many points of superiority over the use of wooden piles.

S. P. SADTLER.

**The Contact Process for Manufacturing Sulphuric Acid of the Verein Chemische Fabriken in Mannheim.** BY WM. WILKE. *J. Soc. Chem. Ind.* January 15, 1906.—The principles of the process are as follows:

First, to use the heat of the ordinary roasting process for carrying on the catalytic action of the oxide of iron upon the sulphur dioxide and oxygen.

Second, the purification of the burner gases in a dry process, as contrasted with other processes.

Third, the conversion of that part of the gases which passes through the iron catalyzer unconverted is effected in a small platinum tube, and reheated to the proper temperature by the waste heat of the burners.

Fourth, the whole process is carried on by moving the gases by means of exhausters.

The waste gases leave the kilns at about 700°, which is a suitable temperature for the catalytic action of the iron oxide. It also enables the iron to fasten the arsenic, and the sulphur dioxide that escaped oxidation passes to a supplementary catalyzer of platinum.

As water injuriously affects the action of the iron oxide, the roasting is done with air that has been dried by passing through sulphuric acid.

The platinum apparatus is built as a series of screens of platinized asbestos.

The first plant in the United States was installed at the works of the Schoellkopf, Hartford and Hanna Co. at Buffalo, N. Y. The original plant was 1600 tons, and has since been enlarged to four times the capacity. Altogether with the plants already installed and being built, there will be a total capacity of 50,000 tons annually. The cost of repairs is very low.

S. P. SADTLER.

**Use of Hydrated Lime in Prepared Plaster Formulas.** BY THOS. W. CAPPON. *Chem. Eng.* December, 1905.—In order to use hydrated lime plasters instead of plaster of Paris or plasters containing large percentages of it, dolomitic lime is used and

after slaking, calcium chloride is added. This reacts with magnesia, forming magnesium chloride, and this then forms magnesium oxychloride with excess of magnesia.

A formula found satisfactory, is: Light colored sea sand, 100 parts; marble flour, 50 parts; hydrated dolomitic lime, 38 parts; calcium chloride, 2 parts.

S. P. SADTLER.

**Nitric Acid of High Concentration.** By A. J. LOTKA. *Eng. Min. J.* November 18, 1905.—Reference is made to a table of percentages of actual nitric acid in concentrated nitric acid as determined by F. Winteler. These are compared with the results found by Lunge, and in addition to these, determinations made by Kolb, and Veley and Manley.

The determinations made by Winteler are in considerable disagreement, not only with the tests made by Lunge and Rey, but also by Veley and Manley. In both of the latter cases the conditions of the experimental work are described, and the specific gravities were taken at 15°, as compared with water at 4°, while with Winteler it was merely stated that the specific gravity was taken at 15°. The curves of Lunge and Veley and Manley agree very closely, showing characteristic changes in the curves at almost the same point, namely, 1.51 sp. gr.

It is the opinion of the present author that the determinations of Lunge, carefully corroborated by skilful workers, should not be discredited until more careful experimental work is carried out.

S. P. SADTLER.

**The Electric Furnace for the Manufacture of Phosphorus.** *Eng. Min. J.* January 13, 1906.—The advantages claimed for this method for the production of phosphorus are that cheaper raw materials may be used, the temperature is more easily regulated, a purer product is obtained, and the use of sulphuric acid is avoided, thus removing the element of serious deterioration, due to its action upon retorts, etc.

In Germany, where one-third the output is already obtained by electric furnace methods, iron retorts are used, lined with fire-clay, and with internally projecting carbon electrodes. The process is continuous, as calcium silicate is drawn off at the bottom while the charge is fed in at the top.

One precaution is given, which is that of keeping the upper part of the furnace and condensing pipes cool (to below 290°C.), in order to avert explosions.

S. P. SADTLER.

**Comparative Costs of Fuel.** *Eng. Min. J.* January 27, 1906.—Credit is given, in this article, to the Automatic Gas Producer Company of New York, for the following figures. These are based on ten working hours per day, and 300 working days per year.

## STEAM ENGINE AND BOILER.

Coal per horse-power hour.	Coal at	3 lbs.	4 lbs.	Cost per horse-power year.				7 lbs.	8 lbs.
				5 lbs.	6 lbs.				
\$2.00 a ton.....	\$ 9.00		\$12.00	\$15.00	\$18.00	\$21.00	\$24.00		
2.50 a ton.....	11.25		15.00	18.75	22.50	26.25	30.00		
3.00 a ton.....	13.50		18.00	22.50	27.00	31.50	36.00		
3.50 a ton.....	15.75		21.00	24.75	31.50	37.00	42.00		
4.00 a ton.....	18.00		24.00	30.06	36.00	42.00	48.00		
4.50 a ton.....	20.25		27.00	33.75	40.50	47.25	54.00		
5.00 a ton.....	22.50		30.00	37.50	45.00	52.50	60.00		

## GAS ENGINE.

Using 20 cubic feet of illuminating gas per horse-power hour :

Cost per 1000 cu. ft...	\$ 0.75	\$ 0.80	\$ 0.85	\$ 0.90	\$ 0.95	\$ 1.00
Cost per H. P. year...	45.00	48.00	51.00	54.00	57.00	60.00

Using 15 cubic feet of natural gas per horse-power hour :

Cost per 1000 cu. ft...	\$ 0.16	\$ 0.18	\$ 0.20	\$ 0.22	\$ 0.24	\$ 0.25
Cost per H. P. year...	7.20	8.10	9.00	9.90	10.80	11.25

Using producer gas—1 $\frac{1}{4}$  lbs. of coal per horse-power hour :

Cost of coal per ton...	\$ 2.00	\$ 2.50	\$ 3.00	\$ 3.50	\$ 4.00	\$ 4.50	\$5.00
Cost per H. P. year...	3.34	4.17	5.00	5.83	6.67	7.50	8.33

## GASOLINE ENGINE.

Using one pint of gasoline per horse-power hour :

Cost per gallon.....	\$ 0.08	\$ 0.09	\$ 0.10	\$ 0.11	\$ 0.12	\$ 0.13	\$0.15
Cost per H. P. year...	30.00	33.75	37.50	41.25	45.00	48.75	56.25

S. P. SADTLER.

## AGRICULTURAL CHEMISTRY.

**The American Leather Chemists' Association. Official Method for Tannin Analysis.** *Leather Manufacture*, Vol. 16, No. 12; *Shoe and Leather Reporter*, Vol. 82, No. 1.

## I. CRUDE MATERIALS.

(1) *Moisture Determination.*—Upon receipt of sample, grind promptly and dry 10 grams in the manner and for the period specified for evaporation and drying in extract analysis.

(2) *Preparation of Sample for Extractions.*—Sample must be dried at a temperature not exceeding 60° and then ground to such a degree of fineness that the entire sample will pass a sieve of 20 meshes to the inch (linear).

(3) *Amount of Sample and Proportion of Water for Extraction.*—For fresh materials the amount of sample and proportion of water for extraction should be such as to give between 0.35 and 0.45 gram tannin per 100 cc. of solution. For spent materials this proportion should be approximated as closely as practicable.

(4) *Extraction of Sample.*—Extraction shall be conducted in a form of apparatus that permits the removal of the extractive



solution from the influence of sustained high temperature, and shall be continued till a portion tested with gelatin salt solution fails to give a precipitate. At least 400 cc. of the first portions of extractive solution should be removed and not subjected to further heating. A thin layer of cotton must be used in order to prevent fine material passing over.

(5) *Analysis*.—After extraction and dilution, solutions must be heated to 80° and the analysis conducted by the official method for extracts. In case of weaker dilutions than the official method specifies the amount of hide powder must be reduced in proportion to the reduction in tannin.

Ten grams of the air-dried sample should be dried as in (2) to determine the moisture content of the portion extracted, and the analysis calculated and reported upon a "dry" basis.

## II. ANALYSIS OF EXTRACTS.

(6) *Amount and Dilution for Analysis*.—Fluid extracts must be allowed to come to room temperature, and weighed in a stoppered weighing-bottle. Such a quantity shall be taken as will give from 0.35 to 0.45 gram tannin per 100 cc. of solution, dissolved in exactly 900 cc. of distilled water at 80°, and made up to the mark after standing not more than twenty hours, nor less than eighteen hours. The temperature must not go below 20°.

(7) *Total Solids*.—Thoroughly mix the solution, pipette 100 cc. into a tared dish, evaporate and dry as directed under "Evaporation and Drying."

(8) *Soluble Solids*.—To 2 grams of kaolin (free from soluble salts) add 75 cc. of the tannin solution, let stand fifteen minutes, decant as much as possible, add 75 cc. of solution, stir and pour immediately on pleated filter-paper No. 590 S. & S., 15 cm. in diameter. Keep filter full, reject first 150 cc. of filtrate, evaporate and dry next 100 cc. as per "Evaporation and Drying." The portion for soluble solids determination must be as clear as practicable, and evaporation during filtration must be guarded against by covering funnel and receiving vessel for filtrate. The temperature of the solution during filtration shall be kept between 20° and 25°.

(9) *Non-tannin*.—A quantity of hide powder sufficient for the number of analyses to be made, shall be prepared in the following manner: Digest with 25 times its weight of water till thoroughly soaked. Add 3 per cent. chrome alum in solution. Agitate by either shaking or stirring occasionally for several hours and let stand over night. Wash by squeezing through linen, continuing the washing until the wash-water gives no precipitate with barium chloride. Squeeze the hide, using a press if necessary, so that the wet hide will contain between 70 and 75 per cent. of water. Use approximately 20 grams of wet hide for moisture determination. Add to 200 cc. of the original solution such quantity of the wet

hide as represents from 12 to 13 grams dry hide. Shake for ten minutes in some form of mechanical shaker and squeeze immediately through linen. Add 2 grams kaolin to the filtrate, stir and filter through folded filter (No. 1 F Swedish, recommended) of size sufficient to hold entire filtrate, returning till clear. Evaporate 100 cc. of the filtrate. The weight of the residue must be corrected for the dilution caused by the water contained in the wet hide powder.

The non-tannin filtrate must not give a precipitate with a 1 per cent. gelatin 10 per cent. salt solution.

(10) *Tannin*.—The tannin content is shown by the difference between the soluble solids and the corrected non-tannins.

### III. ANALYSIS OF LIQUORS.

(11) *Dilution*.—Liquors must be diluted for analysis so as to give as nearly as possible 0.7 gram solids per 100 cc. of solution.

(12) *Total Solids*.—To be determined as in extract analysis.

(13) *Soluble Solids*.—To be determined as in extract analysis.

(14) *Non-tannins*.—To be determined by shaking 200 cc. of solution with an amount of wet chromed hide powder, containing 70 per cent. moisture, corresponding to an amount of dry hide powder shown in the following table:

Tannin range per 100 cc.	Dry hide powder per 100 cc.
0.35-0.45 gram.	8-10 grams.
0.25-0.35 "	5- 8 "
0.15-0.25 "	2- 5 "
0.00-0.15 "	0- 2 "

Solutions to be shaken for non-tannins as in extract analysis, 100 cc. must be evaporated as in extract analysis.

### IV. EVAPORATION AND DRYING.

(15) *Evaporator and Temperature*.—All evaporations and dryings shall be conducted in the form of apparatus known as the "Combined Evaporator and Dryer," at a temperature not less than 98°. The time for evaporation and drying shall be sixteen hours. The method of drying adopted in 1904 shall be continued in force till July 1, 1906.

(16) *Dishes*.—Evaporation and drying of all residues shall be conducted in flat-bottom glass dishes of not less than  $2\frac{3}{4}$  inches in diameter and not greater than 3 inches in diameter.

### V. DETERMINATION OF TOTAL ACIDITY OF LIQUORS.

(17) Place 100 cc. of the liquor in a 500 cc. flask and make up to the mark with water. To 100 cc. of diluted liquor in a flask with tube condenser, add 2 grams of chemically pure animal charcoal. Heat to boiling temperature with frequent shaking, cool, filter and titrate an aliquot portion with decinormal alkali.

## PROVISIONAL METHODS.

(A) *Soluble Solids*.—Stir up 75 cc. of the solution with 1 gram of kaolin, pour upon single-pleated filter-paper No. 590 S. & S., 15 cm., filter and return filtrate for one hour, keeping filter flat. Have cooled a sufficient portion of the original solution to 20° and after removing solution from the filter proceed with filtration of cooled solution discarding at least 10 cc. of the filtrate and collecting the first 100 cc. thereafter coming clear.

(B) *Analysis of Liquors*.—Make up solutions for analysis to contain 0.35 to 0.45 gram tannin per 100 cc., dilutions being made with water at 80°. In each case evaporate such an aliquot portion as will give a residue for soluble solids of approximately from 0.7 to 0.8 gram. Determine soluble solids as in provisional method A. Determine non-tannins as in the official method.

F. P. VEITCH.

**An Extractor for Tannin Materials.** BY H. C. REED. *The Leather Manufacturer*, 17, 1906, Part 1. See this Journal, 28, R 116.

F. P. VEITCH.

**The Chemist in the Tannery.** BY A. A. CLAFLIN. *Shoe and Leather Reporter*, No. 1, 82, 68.—The lines of work which should engage the tannery chemist's attention are discussed generally and the importance of careful research work at all stages of tanning is briefly pointed out.

F. P. VEITCH.

**Tincture of Ginger.** *Bull. No. 110, Lab. Inland Rev. Department, Ottawa, Canada*.—The results of the examination of 108 samples of alcoholic preparations of ginger are reported. The special feature of the examination was the alcoholic strength of the samples, although the examination was not confined to the determination of alcoholic strength.

W. D. BIGELOW.

**Olive Oil.** BY A. MCGILL. *Bull. No. 111, Lab. Inland Rev. Department, Ottawa, Canada*.—The report includes the results of the examination of 108 samples of salad oils, purchased in the markets of the various Canadian provinces. The refractive index and specific gravity was taken in all cases, and frequently the iodine number, nitric acid color test, and Halphen reaction were also determined. The "salad oils" examined invariably consisted of cottonseed oil. Of the 84 samples sold as olive oil, 16 were found to contain cottonseed oil.

W. D. BIGELOW.

**Highly Colored Confectionery.** BY THOMAS MACFARLANE. *Bull. No. 112, Lab. Inland Rev. Dept., Ottawa, Canada*.—The report includes the results of the examination of 111 samples of highly colored confectionery. The only examination made was for metallic impurities which were found to be absent in all cases.

W. D. BIGELOW.



**Detection of Formaldehyde in Witch Hazel.** By W. A. PUCKNER. *Am. J. Pharm.* 77, 501 (1905).—The writer suggests as a reagent for formaldehyde the use of a mixture containing 1 cc. of hamamelis water, 5 cc. of sulphuric acid and a little salicylic acid. This reagent will show the presence of 1 part of formaldehyde in 10,000 of 15 per cent. alcohol. He therefore suggests that as an officinal test for witch hazel extract the following: If 1 cc. hamamelis water be added to 5 cc. of a freshly evaporated solution of 0.01 gram of salicylic acid in 100 cc. sulphuric acid, no red color should appear on standing (absence of formaldehyde).

W. D. BIGELOW.

**Maple Syrup and Maple Sugar Investigations with Particular Reference to the Detection of Adulteration.** By C. H. JONES. *18th Annual Report, Vt. Agr. Expt. Sta. 1904-1905.*—The author has continued and greatly extended his investigations relative to maple sugar and syrup.<sup>1</sup> The number of samples examined has been greatly increased. These samples have been classified into pure and adulterated maple syrup, and the characteristic differences in the analytical data obtained for the classes are pointed out. The pure maple products are further subdivided according to the method of manufacture. Separate tables give the composition of Canadian maple syrup, of different grades of brown sugar, raw cane sugar, beet sugar and glucose. The effect of dissolving, boiling and filtering on pure maple sugar and syrup is given. In addition to the methods used by the author in the preparation of the work embodied in previous reports, the determination of malic acid and of the precipitate obtained with lead subacetate are given considerable attention. Special attention is also given to such popular tests as the aroma when maple syrup of suitable density is heating to boiling. According to the author, people familiar with the maple aroma—chemists and non-chemists alike—have been able in this way to distinguish the pure from the adulterated article, though possessing no previous knowledge of the samples on which they were called to pass. The claim is not made that this test should serve to condemn or pass on suspected samples, but the result considered in connection with other data possesses value. The author states that the characteristic aroma of boiling maple syrup may be obtained even from old and sour samples. Attention is called to the fact that the flavor and color taken together may be used to some advantage in judging of the quality of maple products. Considering the fact that the maple products produced in certain sections of the country have a "molasses taste," however, the author feels that

<sup>1</sup> An early bulletin of the Vermont Station, No. 26, treats of maple sugar manufacture; a recent one, No. 103, deals with the physiological and chemical phases of the maple sap flow; while the 17th report briefly outlines methods used in detecting adulteration in maple products.

it is best not to form hasty opinions from the flavor alone. On the other hand, he states that the color of maple syrup and sugar is no indication of purity. Pure articles may be almost snow-white, or may be almost jet-black, or any intermediate shade of brown. In the author's opinion the general characteristics of maple syrups from different sections of the country may be briefly described as follows: Pennsylvania, sweet and flat (often like molasses), maple flavor; Ohio, mild, delicate almost to flatness, maple flavor; New York, strong, maple flavor; Vermont, mild, delicate, good maple flavor; Canada, good maple flavor. Bulk of product dark in color, with strong flavor, occasioned by demand. As far as marketable differences go, there is but small choice between Vermont, New York, and Canadian goods of equal grade. The methods employed by the author are given, and considerations to be employed in judging of samples by means of those methods are discussed in detail. W. D. BIGELOW.

**Food Inspection.** By F. W. ROBINSON. *Bulletins Nos. 120, 121, 122 Mich. Dairy and Food Dept.*—A detailed report is made of the examination of 138 samples of food products. The following tabular statement is also given:

## SUMMARY.

Article.	Totals.	Not found adulterated.	Found adulterated.
Baking-powder.....	1	1	0
Butter ..	9	1	8
Cocoa .....	1	0	1
Coloring powders .....	1	1	0
Extracts (flavoring).....	9	1	8
Honey.....	10	10	0
Jelly and jam .....	6	3	3
Lard.....	1	1	0
Maple syrup .....	5	1	4
Milk .....	71	39	32
Mustard .....	2	0	2
Oleomargarine .....	7	0	7
Olive oil.....	1	1	0
Pepper .....	2	2	0
Preserves ..	2	0	2
Vinegar .....	10	0	10
Total.....	138	61	77

W. D. BIGELOW.

**Report of the Chemist.** By R. HARCOURT. *Thirty-first Annual Report, Ontario Agricultural College.*—The report includes the results of the analysis of a wide range of agricultural products. The author's work relative to the composition of different grades of flour is continued, and the analysis, including the total nitrogen

and nitrogen in the form of gliadin and glutenin, is given in a number of samples. Experiments have also been made with regard to the yield of bread from 100 barrels of flour of different grades, and the quality of the bread. Partial analyses, including total proteids and alcohol-soluble proteids in 26 samples of wheat, are given. Considerable attention was also given to the study of the soils and sugar-beets. The report includes the percentage of solids and purity in a number of varieties of sugar-beets, and gives the results of a study of the influence of certain cultural methods on the composition of the beet.

W. D. BIGELOW.

**Alfalfa—Methods of Culture.** BY G. A. BILLINGS. *Bull. 190, New Jersey Agr. Expt. Sta.*—The experience of the successful farmers in the State indicates that alfalfa can be grown on all kinds of soils that are well prepared for the seed, and that contain lime, the usual quantity of plant food and the proper nitrogen-fixing bacteria.

F. P. VEITCH.

**Report of the Chemist.** BY A. GOSS AND W. J. JONES. *18th Annual Report, Indiana Agr. Expt. Sta.*—The various lines of work conducted by the station embracing fertilizer experiments, soil studies, and the effect of various materials on soil fertility, are briefly outlined.

F. P. VEITCH.

**Fertilizers.** BY E. H. JENKINS AND A. L. WINTON. *Report of Conn. Agr. Expt. Sta., 1905, Part 1.*—Tabulated analyses and discussions of analyses of various fertilizers, fertilizer materials and miscellaneous waste materials offered for sale in the State.

F. P. VEITCH.

**Commercial Fertilizers Licensed to be Sold during 1905.** *Official Report Secretary Ohio State Board Agr.*—This report contains analyses of numerous brands of fertilizers and the text of the State fertilizer law.

F. P. VEITCH.

**Report of the Chemist.** BY A. L. KNISELY. *17th Annual Report, Oregon Agr. Expt. Sta. 1905.*—This report contains a brief outline of the work of the Station on soils and fertilizers and fertilizer experiments.

F. P. VEITCH.

**Analysis of Fertilizer Supplies, Home Mixtures and Special Compounds. Analyses and Valuations of Commercial Fertilizers and Ground Bone.** BY J. P. STREET *et al.* *Bull. 188, N. J. Agr. Expt. Sta.*

F. P. VEITCH.

**Fertilizer Inspection.** BY J. M. BARTLETT. *Bull. 120, Maine Agr. Expt. Sta.*

F. P. VEITCH.



## PATENTS.

SEPTEMBER 5, 1906.

798,603. Willis E. Everette, Tacoma, Wash. **Insecticide.** Equal parts of sulphur, pine resin, soap powder, sodium oxide, tobacco stems, castor oil beans, pyrethrum flowers, asphalt petroleum, fuming sulphuric acid and phenol alcohol.

798,715. Lancelot W. Thompson, Hobart Mills, Cal. **Incrustation preventive.** Water 32, potatoes 17, brown sugar 12, and kerosene 6 pounds.

798,755. Joseph Thomlinson, Portland, Oregon. **Hydrating lime.** Sand 300, sugar 15, petroleum 2, and water 80 parts are mixed and heated to a boil, and the lime added thereto, then the mass is mixed, dried and screened.

798,780. Wm. A. Gill, Tarrytown, N. Y. Assignor to Rendrock Powder Co., N. Y. **Blasting powder.** Potassium chlorate 80, resin 18, asphalt and nitrated wood fiber one part each.

798,788. Robert O. Hayt, Corning, N. Y. **Fire-brick.** Powdered siloxicon is mixed with liquid sodium silicate, molded, and the sodium burned out.

798,790. Carl Hering, Philadelphia, Pa. **Electrolytic process.** The process of electro-deposition of zinc which consists in electrolyzing zinc sulphate in solution, with a cathode of lead peroxide and an anode of spongy lead.

798,807. August L. Laska, Offenbach-on-Main, Germany. Assignor to K. Oehler, Anilin Fabrik, same place. **Indophenol-sulphonic acid.** Pure paraphenylenesulphonic acid and a phenol are simultaneously oxidized by sodium hypochlorite in alkaline solution, forming, after drying, a sodium salt which is a black-brown powder, soluble in water blue-violet, becoming bluer on adding sodium lye and blue-black on treatment with hydrochloric acid.

798,808. As above, for **blue azo wool dye.**  $\beta$ -Hydroxynaphthoic acid melting at  $216^{\circ}$  C. is combined with diazotized 6-nitro-2-aminophenol-4-sulphonic acid, that as an alkali salt is a blackish brown powder, dissolving in concentrated sulphuric acid blue-red, in water violet, turning yellow-red on adding hydrochloric acid, which at the same time separates a flocky precipitate, and becoming blue-red by soda lye.

798,837. Franklin H. Stanly, Cleveland, Ohio. **Renovating butter.** A mixture of butter-oil and milk is agitated by steam under pressure, then casein added, and the mixture centrifugated.

798,863. Julius Altschul, Berlin, Germany. **Dialkylbarbituric acid.** Dialkylmalonamide is condensed with dialkyl carbonates in the presence of alkaline condensing agents and the acid separated.

798,868. Henry Bernstein, Philadelphia, Pa. Assignor to Art Fiber Co., of New Jersey. **Artificial silk.** Cellulose is dissolved in cuprammonium hydrate, the liquor from boiled raw silk added, and the fiber made and washed in a mixture of castor oil, sulphuric acid and sodium hydroxide.

798,887. Viggo Drewson, New York, N. Y. **Soft absorbent pith from cornstalk, etc.** The pith is separated and cooked in a lye containing 15 to 30 per cent. of caustic soda and under steam pressure of 60 to 100 pounds, for four to ten hours till the pith cells are converted into a soft absorbent pulp.

798,920. Emil Von Portheim, Prague, Austria-Hungary. **Reducing oxalic acid** by electrolysis. Compounds containing the radical oxalyl ( $C_2O_2$ ) are dissolved in a cathode compartment of an electrolytic apparatus, and the current passed at a low temperature.

798,949-50. Willis W. Case, Denver, Col. **Assay furnace.** The muffle is placed in front of the crucibles, all having a common chimney, and a pipe so arranged as to draw air through the muffle.

798,951. Peter C. D. Castle, Bebington, England. **Water-proofing leather.** A mixture of the flour of the locust bean and oil is placed between two layers of fabric or leather.

798,964. Horace F. Hodges and Joseph Kuen, Philadelphia, Pa. **Purifying water.** Assignors to American Water Purifying Co., Delaware. A series of condensing chambers are supplied with high pressure steam which is condensed by transferring its heat to other bodies of water to be heated.

799,003. All as above for similar apparatus.

SEPTEMBER 12, 1905.

799,058. Carl Immerheiser, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Azo dye lake.** The azo dye is made from return xyloidine and  $\beta$ -naphthol and is mixed with heavy-spar.

799,065. Abraham Kronstein, Karlsruhe, Germany. **Varnish gum.** An excess of wood oil is heated with a suitable amount of resin and drying oils added, the mixture is then heated till it solidifies at above  $200^{\circ}C$ . and an alkali-resisting, solid compound obtained.

799,113. John A. Titzel, Sr., Newcastle, Pa. **Pigment.** The waste material from converter stacks is comminuted and subjected to the heat of a natural gas flame and of superheated steam.

SEPTEMBER 19, 1905.

799,642. Herman Frasch, Cleveland, Ohio. **Mining sulphur.** Water which is heated above the point at which molten

sulphur begins to darken is forced into the mine to fuse the sulphur, which then separates from the water by gravity. Air or other aeriform fluid is introduced into the sulphur which is raised by pressure to the level of the ground, the air escaping from it while it is still in the molten condition.

799,678. Dominick W. Sharkey, New York, N. Y. **Insulating material.** A fibrous material, as asbestos, is mixed with the waste products of the Solvay soda-ash process.

799,687. Everard Steele, Berlin, Germany. **Explosive.** A compound consisting of a nitrated mixture of resin and a vegetable meal, an oxidizing agent and from 0.5 to 5 per cent. of powdered aluminum. The product should contain 46.47 carbon, 3.76 hydrogen, 6.58 nitrogen and 43.27 per cent. oxygen.

799,696. Charles H. Ward, Sydney, New South Wales, Australia. **Treating sulphides and complex ores.** The ore, heated in the presence of air, is made to pass through heated gases moving in the opposite direction. Sodium chloride is then added to it and the mixture is subjected to the gases formed in the first step of the process, both ore and gases moving in the same direction, and their temperature being reduced.

799,705. Max Bielefeldt, Berlin, Germany. **Nitroglycerol explosive.** Dinitromonochlorhydrin to between 15 and 25 per cent. of the contained nitroglycerol is added to protect the explosive from the danger of freezing.

799,706. Ernest Bloch, Basel, Switzerland. **Benzoylsalicylic acid.** Disodium salicylate is treated with the molecular quantity of benzoyl chloride after dilution with ether, and the free acid is removed from the sodium benzoylsalicylate thus obtained by acetic acid. The acid is sparingly soluble in water, but easily soluble in ether, alcohol and chloroform; melts at 132° and splits up into salicylic and benzoic acids by boiling with an alkali.

799,743. Philip A. Mackay, Wenona, Ill. **Treating zinc ores.** Ores of zinc sulphide containing cadmium sulphide are subjected to a dead roast to oxidize the zinc sulphide and to convert the cadmium sulphide into sulphate, which is then dissolved out by water; the zinc oxide is then ground and distilled to obtain pure refined zinc.

799,749. John J. Mossop and William Magrady, Philadelphia, Pa. Assignors of one-fourth to Charles Donovan and one-fourth to Joseph F. Donovan. **Soldering compound.** A composition for use in brazing cast iron which consists of prussiate of potash 2, hydrochloric acid and ammonium chloride 1 part each, and water 4 parts.

799,764. Fritz H. Tritschler, Basel, Switzerland. Assignor to F. Hoffmann, La Roche & Co., Basel, Switzerland. **Theo-**



**bromine-sodium formate.** Sodium theobromine and anhydrous sodium formate in molecular proportions are made to react upon each other in aqueous solution, producing theobromine-sodium formate  $\text{NaC}_4\text{H}_7\text{N}_4\text{O}_2 + \text{NaCOOH} + \text{H}_2\text{O}$ , containing approximately 62.5 per cent. of theobromine, 23.5 per cent. of anhydrous sodium formate, and 6.4 per cent. of water. In its dry condition it is a white powder, of a bitter saline taste, yielding an alkaline solution with water, yields theobromine on addition of acetic acid to its solution, and formic acid enters into the solution. It is applicable as a diuretic.

799,766. Hugo R. Volland, St. Louis, Mo. **Preserving plaster and other bodies from moisture.** The body to be protected is first coated with a thin solution of sizing material such as glue or paint, and then covered with a metallic covering as tin foil and then applying a coating of water-proof coloring-matter to the metallic coat.

799,770. Adolf Wultzer, Charlottenburg, Germany. **Making lead carbonates.** Lead acetates are acted upon by carbonic acid at sudden overpressure, at least one atmosphere, precipitating the carbonate in a very short time, and subsequently preventing crystallization.

799,860. Guy L. Meaker, Evanston, Ill. Assignor to the American Steel and Wire Co., of New Jersey. **Galvanizing wire.** Wire is made to pass continuously as a cathode through a ferriferous zinc solution in the presence of an insoluble anode, oxidizing the solution to render the iron neutral by giving the anode a larger surface than the cathode, and superimposing upon the deposit formed at the connection points of the cathode wire the deposits formed at the intermediate points between such connection points.

799,862. Same. **Separating ferriferous zinc.** The compound is dissolved in an electrolytic solution, and the solution is transferred from the point of formation to an anode of insoluble material adjacent to a cathode of smaller superficial area; an electric current is passed from the anode to the cathode through the solution, and the solution oxidized, whereby the zinc is deposited upon the cathode and the iron precipitated in an insoluble basic, ferrous or ferric form.

799,876. Claus A. Spreckels and Chas. A. Kern, New York, N. Y. Assignors to Federal Sugar Refining Co., Jersey City, N. J. **Composition for cleansing sugar.** An oleaginous body, such as rosin-oil, is sulphonated by treatment with sulphuric acid at a low temperature, and the product, which is soluble in ethyl and amyl alcohols, is separated from the mixture and to it is added a hydrocarbon oil, such as kerosene.

799,910. Tom C. King, Marion, Ala. Assignor to National

Metallurgical Company, Jersey City, N. J. **Nodule of metal-liferous material.** A permanently anhydrous and porous nodule made from finely divided metalliferous materials and composed of metals in the form of oxide cohered by partial fusion and uncontaminated by any foreign deleterious substance.

799,955. Leo Weber, Darmstadt, Germany. Making **guanine**. 2-Cyanamido-4,5-diamino-6-oxypyrimidine is heated with formic acid.

800,110. John W. Ivery, Dillsburg, Pa. **Plastic composition.** Consists of about 200 pounds of granulated rock, 1 pound of molasses, 15 pounds of water.

800,145. Frances X. Govers, Owego, N. Y. Assignor to Americus Manufacturing Co., New York, N. Y. **Fabric coating.** Casein precipitated by sulphuric acid 50, sodium phosphate 10, sodium hyposulphite 5, and water 200 parts. China clay 300 and satin white 30, with 5 per cent. of vegetable wax may be added as a filler. The composition makes a flexible coating for fabric or paper.

800,218. Rudolph Knietsch, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. Making **sulphuric acid**. Sulphuric anhydride is mixed with fuming sulphuric acid containing not less than 27 per cent. of free sulphuric anhydride and a diluent, which may be steam, water or dilute acid in an iron vessel, which is not attacked, and pure acid produced.

800,223. Meredith Leitch, Brooklyn, N. Y. **Treating tin scrap.** Tin is recovered from old tin cans by volatilizing and carbonizing the filth in a deoxidized atmosphere and the tin cans are subjected to mechanical blows while in the heated atmosphere to disintegrate them.

800,255. Harold L. Wood, Montreal, Canada. **Food compound.** Milk is diluted with about one and one-half times its volume of water and the mixture is raised to 15° to 20°, and sufficient hydrochloric acid is added to precipitate the casein; the precipitate is then filtered and washed to remove a portion of the calcium; a portion of the water is also removed. Salts are added to render the casein soluble, and also in small proportion ferric chloride, manganous chloride, tripotassium citrate, and magnesium oxide, and finally invert sugar is incorporated with the mass.

800,369. Robert Gray, George Osborn, Herbert B. Stocks and Henry G. White, Hooton, England. Assignors to the Gum Tragasol Supply Co. Ltd., same place. **Obtaining gum tragasol from locust beans.** The beans are boiled for half an hour until sufficiently soft and the surplus of water removed; when the husks are soft enough they are removed in an ordinary decortica-

ting machine. The cotyledons are washed and the residual matter rendered insoluble by a precipitant, as a soluble salt of alumina, and the gum immediately extracted in the usual manner.

800,380. Florentine J. Machalske, Brooklyn, N. Y. Assignor to Frederick Darlington, Great Barrington, Mass. **Producing alkali and alkaline-earth metal hydrides.** A saturated hydrocarbon like methane is made to react with a compound of an alkali or alkaline earth metal at a temperature sufficiently high to effect reduction of the compound and to cause combination of its base with hydrogen.

800,442. Paul Holzach and Ernest Preiswerk, Basel, Switzerland. Assignors to Society of Chemical Industry in Basel, same place. **Alkyl salicylglycolate.** Sodium salicylate is heated with an excess of methyl and ethyl chloracetates; the sodium chloride formed in each case is removed and each product is distilled in vacuum to obtain a colorless, odorless crystalline mass, which is recrystallized to obtain pure crystallized methyl salicylglycolate and pure ethyl salicylglycolate; the two are melted together to obtain a therapeutic product which at ordinary temperature is a liquid. The crystallized product is soluble in alcohol, ether, benzene and castor oil; insoluble in water; soluble in aqueous caustic alkalies and saponifiable when such solutions are heated, with the formation of salicylic acid, glycolic acid and alcohol. A mixture of the two crystallized products yields at ordinary temperature a liquid which is colorless and almost odorless, density 1.26 at 18° centigrade, soluble in the same menstrua as the solid product.

800,448. William B. Kerr, Medford, Mass. Making **malted cocoa or chocolate.** Coarse chocolate or cocoa and malt are ground together, water is added and the whole boiled; after cooling to 110° F. papain is added and the mass stirred at that temperature for twenty minutes; it is then reboiled, the water removed and the residuum left in the form of a powder.

800,506. Charles H. Sproessig, New York, N. Y. **Compound for cleaning.** A mixture of fine wood powder 6, soap-powder 2, and coal-oil 1 (quarts), wintergreen oil and carbolic acid a few drops each. A dry powder when mixed.

800,511. John Stuckes, St. Louis, Mo. Making **candy.** Two separate masses of candy are made by boiling sugar and corn sugar (glucose) in water, one mass having a greater proportion of glucose than the other. The mass of candy containing the larger proportion of glucose is mixed with a common, wholesome fat and forms the interior of the candy, the outer shell being made from the mass which contains the lesser proportion of glucose.



SEPTEMBER 26, 1905.

800,130. Robert H. Aiken, Winthrop Harbor, Ill. **Separating nickel from mattes.** Nickel is removed from copper-nickel-sulphide mattes by adding to the molten matte in a converter a flux material containing not less than 70 per cent. of silica at a temperature between 800° and 1700° centigrade; the whole is subjected to an air-blast to oxidize the nickel, and the nickel-silicate slag formed is removed before the blast has materially acted upon the copper.

800,144. Francis X. Govers, Owego, N. Y. **Water-proof coating.** Casein is dissolved in ammonium hydroxide and to the solution is added wax and calcium sulphate. After applying the coating to the fabric the solvent is evaporated at or above 110° F.

800,145. Same. **Fabric coating.** Consists of sulphuric acid casein 50, sodium phosphate 10, sodium hyposulphite 5, China clay 200, wax 5, satin white 20, and water 200 parts by weight.

800,146. Same. **Insoluble fabric coating.** Substantially same as above with addition of formaldehyde.

800,181. Heinrich Specketer, Griesheim-on-Main, [Germany. Assignor to the firm of Chemische Fabrik Griesheim Electron, Frankfort-on-Main, Germany. **Producing electrodes.** Technically pure non-magnetic oxide of iron is melted and cast in suitable molds.

800,197. Richard Wolfenstein, Berlin, Germany. **Preservation of feathers.** A dilute solution of wax in methyl alcohol is applied to the feathers and the solvent is then driven off.

800,201. Jacob E. Bloom, U. S. Army. **Food preparations.** To food-stuff from which all visible and tissue fat has been removed is added an oil or fat, comprising olein, palmitin and stearin, in such quantities that the resulting food shall contain these principles in about the proportion in which they exist in human fat.

800,563. Army Geipel, Plauen in Vogtland, Germany. **Plastic mass.** The pulp-like mass resulting from the treatment of the bast of the monkey-bread tree (*Adansonia L.*) and similar plants with alkali, is separated from the fibers by washing and pressing the mass into desired shapes.

800,606. John B. N. Berry, Washington, D. C. **Making plaster or mortar.** The spent lime from gas purifiers is mixed with a clay rich in aluminum, the mass reduced to a powder and calcined at a heat below that which would destroy the setting qualities of the sulphate of lime.

W. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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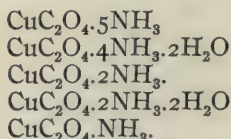
## GENERAL AND PHYSICAL CHEMISTRY.

**A Cooperative Plan for Systematic Research Work.** By JOHN R. MARDICK. *Chem. Eng.* 3, 133-138.—The gist of the writer's argument is embodied in the following extracts from his concluding remarks: "These facts indicate, first, that there are many scientific technical problems in industries which are neglected and which need immediate attention; second, that much energy is wasted on Utopian questions without apparent or immediate results. While all these investigations may eventually prove useful, we believe that a certain coöperation between investigators and practical men would be highly beneficial both to science and to industry. Even though manufacturers refuse admittance to their plants, they will be glad to discuss, or even to submit, problems for investigation." The following tentative plan for coöperation is suggested: "Let every department of a college, university or other institution engaged in research work, invite its alumni once each year for conferences; *viz.*, the electrical, chemical, mechanical, mining and civil engineering departments, each its respective graduates; let each department, in a separate section, open discussion in its own line, its alumni, from their practical experience, suggesting problems that most need investigation. Then during the course of the coming year, the heads of these various departments, thus supplied with up-to-date practical questions, will be able to interest their assistants and graduating students in research and thesis work. Moreover, the alumni will be in a position to supply material for investigation." By some such scheme the research work will be placed on a practical coöperative and systematic basis; there will be a beneficial mingling of practical and theoretical minds; the industries and the public will benefit more from the work of the colleges; the alumni will be held in closer relation to the latter.

W. F. HILLEBRAND.

## INORGANIC CHEMISTRY.

**On Some Cuprammonium Salts.** BY D. W. HORN. *Am. Ch. J.* **35**, 271-285.—The paper presents an account of some cuprammonium oxalates, and considers their bearings on the question of types in this class of salt. The following formulae are given:



These salts are all new except the fourth. The author describes in detail the methods used to prepare these substances. The investigations, of which this paper forms a part, have for their object the problem of finding out whether the acid residue exerts any effect upon the composition and stability of the salt, and of the complex ion. There seems to be good ground for assuming that this is the case. In illustration the author cites the tetrammonium salts obtained from copper sulphate, nitrate, chloride, and tartrate, and compares them as regards stability, and their power of influencing such values as the molecular-lowering of the freezing-point, the electrical conductivity, viscosity, etc. The differences observed seem to require as a possible explanation, either the effect of the "water of crystallization," or the influence of different acid radicals. Opposition is raised to the usual practice of speaking of complex cuprammonium compounds which have either four or two  $\text{NH}_3$  groups, as fundamental types. The pentammonium derivative of the oxalate, formed in the presence of water, suggests that such a rigid classification into a limited number of types is not justified. The author considers that the formation of particular cuprammonium salts depends upon the conditions of equilibrium which exist at the time the salts are formed. With varying concentrations of water, ammonia, and copper salt, the proportions vary. When the relative concentration of ammonia is large, the complex salt with the larger amount of  $\text{NH}_3$  is formed; with a large concentration of water, those complexes result which have smaller proportions of  $\text{NH}_3$ . In the case of the anhydrous salt, that is, in the absence of water, the formation of higher ammonia complexes is favored. The author considers, therefore, that, between the limits  $+6\text{NH}_3$  and  $+\text{NH}_3$ , only the effect of mass action need be considered.

LAUDER W. JONES.

**The Double Salts of Mercuric Chloride with the Alkali Chlorides and their Solubilities.** BY H. W. FOOTE AND L. H. LEVY. *Am. Ch. J.* **35**, 236-246.—The present article is a



continuation of similar determinations made with caesium mercuric chloride (*Am. Ch. J.* **30**, 339). The so-called solubility method described by Wells (*Am. J. Sci.* **44**, 221) was employed. Varying mixtures of mercuric chloride and alkali chloride, carefully weighed, were treated with hot water enough to dissolve them, and were shaken in a thermostat at 25° for several days. Weighed quantities of the solutions were filtered and analyzed, the residues were dried quickly and analyzed. A series of two or more results giving a constant composition of the residue and a varying solubility, shows a pure double salt to be present, while a constant solubility and a varying residue indicate a mixture of two salts. In this manner the authors establish the existence of the following double salts, at a temperature of 25°.

Potassium.	Sodium.	Rubidium.
$2\text{KCl} \cdot \text{HgCl}_2 \cdot \text{H}_2\text{O}$	$\text{NaCl} \cdot \text{HgCl}_2 \cdot 2\text{H}_2\text{O}$	$\text{RbCl} \cdot 5\text{HgCl}_2$
$\text{KCl} \cdot \text{HgCl}_2 \cdot \text{H}_2\text{O}$		$3\text{RbCl} \cdot 4\text{HgCl}_2 \cdot \text{H}_2\text{O}$
$\text{KCl} \cdot 2\text{HgCl}_2 \cdot 2\text{H}_2\text{O}$		$\text{RbCl} \cdot \text{HgCl}_2 \cdot \text{H}_2\text{O}$
		$3\text{RbCl} \cdot 2\text{HgCl}_2 \cdot 2\text{H}_2\text{O}$
		$2\text{RbCl} \cdot \text{HgCl}_2 \cdot \text{H}_2\text{O}$

At the close of the article, an interesting comparison of the solubilities of the salts of the different alkali metals is given in diagrammatic form.

LAUDER W. JONES.

**Uses of the Rare Earths.** BY CHARLES BASKERVILLE. *Eng. Min. J.* November 25 and December 9, 1905.—In Part I, a very interesting account is presented of the uses of rare earths in processes of illumination. A brief historical review is given of the development of the present gas mantles, and a brief account of the Nernst filaments. Part II deals with the applications of rare earths in the following practical directions: Alloys, Therapeutics, Pigments, Dyeing (Mordants), Glass Coloring, Electric Batteries, Fire-proofings, Catalytics, Reagents, Photography.

LAUDER W. JONES.

**A Study of the Reactions Involved in the Formation of Certain Complex Salts of Lead.** BY JOHN WHITE AND J. M. NELSON. *Am. Ch. J.* **35**, 227–235.—This article is a continuation of the investigations of White (*Am. Ch. J.* **31**, 1). The authors tried to prepare a salt of the composition  $\text{PbI}(\text{C}_2\text{H}_3\text{O}_2)$ , but could not isolate this substance. The reactions seem to point to the transient existence of such a compound.

LAUDER W. JONES.

**Reaction between Lead Chloride and Lead Acetate in Acetic Acid and Water Solutions.** BY JOHN WHITE. *Am. Ch. J.* **35**, 217–227.—The experiments described were carried out with the object of determining the character of the compounds formed when certain lead salts are dissolved by alkali acetates. By a study of conductivity and migration measurements, Noyes and

Whitcomb (this Journal, 27, 747) have concluded that the increased solubility of lead sulphate is due mainly to double decomposition, with the formation of unionized lead acetate. The author, however, inclines to the belief that, at least in some cases, the complex ion hypothesis more nearly represents the relations. It is pointed out, that lead chloride is dissolved when a solution of lead acetate is used as a solvent. Here there can be no question of metathesis; yet lead chloride is distinctly more soluble in lead acetate solution than in water alone. Two well-defined crystalline salts were obtained. One was produced when lead chloride was dissolved in a hot acetic acid solution of lead acetate; the other, when a water solution of lead acetate was used to dissolve the chloride. The probable formulae are:  $\text{PbCl}(\text{C}_2\text{H}_3\text{O}_2) \cdot \text{C}_2\text{H}_4\text{O}_2$  and  $\text{PbCl}(\text{C}_2\text{H}_3\text{O}_2) \cdot \text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$ . This shows that the nature of the solvent influences the character of the salt formed. Molecular weight determinations gave values approximately one-fourth of the molecular weight calculated. This would point to dissociation of the salts.

LAUDER W. JONES.

**The Relation between the Radioactivity and the Composition of Uranium Compounds.** By HERBERT N. MCCOY. *Phil. Mag.* [6] 11, 176-186 (1906).—The activity of all uranium ores is several times as great as that of pure uranium compounds of equal uranium content. This excess of activity, due to radium and its products, may be easily removed by dissolving the uranium compound, which has been separated from the ore by ordinary methods, in an excess of ammonium carbonate solution and adding alternately barium chloride and ammonium sulphate. Three precipitates of barium sulphate remove practically all of the radium, etc. The activity of the  $\text{U}_3\text{O}_8$  so purified could not be further reduced. 0.8 to 1.0 grams of this oxide made into a uniform film of about 40 sq. cm. area was taken as a *standard of radioactivity*. The *total* activity of 1 gram of uranium is 791 times the observed activity of 1 sq. cm. of the standard film. The activities of several uranium ores, free from thorium, were measured by the method previously used for pure uranium compounds (this Journal, 27, 391 (1905)). The results show that for any ore the activity of that quantity containing 1 gram of uranium is a constant = 3280, the unit of activity being 1 sq. cm. of the standard film of  $\text{U}_3\text{O}_8$ . Therefore, for equal uranium content, the ores are  $3280/791 = 4.15$  times as active as the pure substances, freed from radium and its products. These results confirm earlier, less accurate, measurements (this Journal, 27, R 381 (1905)).

H. N. MCCOY.

**The Chemical Separation of the Radioactive Types of Matter in Thorium Compounds.** By HERMAN SCHLUNDT AND RICHARD B. MOORE. *J. Phys. Chem.* 9, 682.—When thorium solu-

tions are precipitated by pyridine 90 per cent. or more of the ThX and part of the ThA remain in the filtrate. Three successive precipitations give thorium free from ThX. The residues obtained by igniting the pyridine filtrates always become more active, in the course of a few hours, than similar residues obtained by means of ammonia. The greater activity in the former case was proved to be due to the presence in the residues of ThA. Fumaric acid removes ThX and ThA from thorium more readily than does pyridine. The thorium fumarate when dissolved in nitric acid, immediately after precipitation, gave upon electrolysis, after the addition of a trace of lead, an inactive anodic deposit, which remained inactive, showing the absence of ThA. The cathodic deposit was highly active and decayed exponentially to half value in fifty-five minutes; it was therefore ThB. The decay and recovery curves of the various products were studied and compared with the theoretical values. Many other reagents remove part of the activity of thorium compounds, but inactive thorium was not obtained.

H. N. McCoy.

**On the Chemical Separation of the Excited Activity of Thorium.** By HERMAN SCHLUNDT AND RICHARD B. MOORE. *Trans. Am. Electrochem. Soc.* **8**, 269-279 (1906).—A solution of ThA and ThB was obtained by dissolving the active deposit from the emanation in dilute acid. The precipitate produced in this solution by a little ferric solution and ammonia contained 98 per cent. of the ThA and ThB. That produced by ferric solution and pyridine contained most of the ThB while the ThA was left in the filtrate. A precipitate of ferric fumarate behaves in the same way. A precipitate of barium sulphate carries down ThA, while the ThB remains in the filtrate. Silver chloride does not carry down either ThA or ThB. The products ThA and ThB were recognized by their rates of decay. The chloride of ThA is volatile at a low red heat, and can thus be removed from ThB, which is much less volatile.

H. N. McCoy.

**On the Radioactivity of Metals Generally.** By J. C. McLENAN AND E. F. BURTON. *Phil. Mag.* (6) **6**, 343-350 (1903), also *Trans. Roy. Soc. Canada*, **9**, (III), 37-43 (1903), also Univ. of Toronto, *Phys. Sci. Series*, No. 3 (1903).—When a cylinder of any metal is enclosed within a second of the same material, insulated from it, and surrounded by air or other gases, it gradually acquires a negative charge, and after one to four hours reaches a state of equilibrium at a definite potential below that of the enclosing cylinder. The maximum difference of potential is characteristic for each metal and is the same for different samples of the same metal. It varies but little with the nature of the gas between the cylinders. Equilibrium is reached more quickly under the influence of Röntgen or Becquerel rays but the maxi-



mum potentials are the same. With cylinders of different metals the final potential depends upon which of the pair is the inner one. From the data so obtained the Volta effects were calculated, and found to be considerably below the values generally accepted. In explanation of the phenomena the authors suggest that a process is going on at the surface of the metal, whereby an excess of positively charged corpuscles is being continually emitted, and that the steady state attained represents a condition of equilibrium in which the current between the cylinders is equal to the rate of efflux of the positive charges. H. N. McCoy.

**On the Character of Radiations from Ordinary Metals.** By E. F. BURTON. *Phys. Rev.* **18**, 188-191 (1904); *Phys. Ztschr.* **5**, 444-445 (1904).—The natural electrical conductivity of air contained in a galvanized iron cylinder is decreased 32 per cent. when external penetrating radiations are cut off by a screen of water 60 cm. thick, and nearly in the same ratio by thinner screens. When shielded by the 60 cm. screen, the conductivity decreased continuously with decrease of air pressure in the cylinder for pressures between 752 and 19 mm. of mercury. The natural conductivity of air is thought to be caused by a highly penetrating radiation. H. N. McCoy.

#### MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Report on the Lead and Zinc Deposits of Wisconsin, with an Atlas of Detailed Maps.** By U. S. GRANT. *Wisconsin Geol. and Nat. Hist. Survey, Bull.* **14**, 100 pp.; maps, plates, figures.—This report is in continuation of the preliminary work published in *Bull.* **9** (this Journal, **25**, R 349. See also **28**, R 130, for the chief points on ore occurrence and genesis).

W. F. HILLEBRAND.

**Lead and Zinc Deposits of the Virginia-Tennessee Region.** By T. L. WATSON. *Trans. A. I. M. E. Bi-monthly Bull.* March, 1906, pp. 129-195; figures.—The greater part of this article, that relating to the Virginia deposits, is a condensation of *Bull.* **1**, *Geol. Survey of Virginia* (see this Journal, **28**, R 5). The remainder is devoted to the Tennessee deposits adjoining, of which no detailed records have heretofore been published. The general conclusions arrived at as to the Virginia deposits apply to those of Tennessee, so that it suffices to refer the reader to the above cited abstract.

W. F. HILLEBRAND.

**The Classification of Coals.** By PERSIFOR FRAZER. *Trans. A. I. M. E. Bi-monthly Bull.* March, 1906, pp. 239-246.—The author discusses the paper on the same subject by M. R. Campbell (this Journal, **28**, R 3) in a generally appreciative spirit, though unwilling to accept as altogether valid Mr. Campbell's

objections to the proximate-analysis-fuel-ratio system. He also doubts if Mr. Campbell's twelve groups will ever become firmly established, or be of much assistance, if established.

W. F. HILLEBRAND.

**Report on the Operations of the Coal-testing Plant of the United States Geological Survey at the Louisiana Purchase Exposition, St. Louis, Mo., 1904. Part I.—Field Work, Classification of Coals, Chemical Work.** EDWARD W. PARKER, JOSEPH A. HOLMES, MARIUS R. CAMPBELL, Committee in Charge. *U. S. Geol. Survey, Professional Paper No. 48*, 300 pp.; map, plates, figures.—In the chapter on Field Work (125 pp.), by M. R. Campbell, the data are arranged by states, and they include brief descriptions of the seams in the mines from which samples were taken, the character of the car samples, and the manner of taking the mine samples. The chapter closes with a section on the Commercial Value of Coal-mine Sampling (this Journal, 28, R 9). The next chapter, on Classification of Coals, by the same author, has already been noticed in this Review (28, R 3). The final chapter (127 pp.), Work of the Chemical Laboratory, by N. W. Lord, is a more detailed report than that given in the preliminary publication of the committee (see this Journal, 27, R 262). In it are to be found full descriptions of all analytical methods with a long array of tabulated results, and descriptions of the results of experimental work on a variety of subjects connected with analytical methods. These last will be of great interest to all who have to analyze coals. They comprise: Determinations of the sulphur retained in the residues from water-extraction in the Eschka method, which confirm the results obtained by Mr. Geo. Steiger in the Geol. Survey laboratory (this Journal, 21, 1128); comparisons of the results of determining sulphur by the Eschka and bomb methods, of phosphorus by direct weighing of the yellow precipitate and precipitation as phosphate, and of nitrogen in mine samples and car samples; very important work on the variations in moisture; experimental work on different methods of sampling; laboratory tests for coking properties.

W. F. HILLEBRAND.

**Fuel Value of Some Tennessee and Kentucky Coals.** By CHAS. E. FERRIS. *Eng. Assoc. of the South*, 16, 141-147; figure.—A table is given of the results in B. T. U. values of tests by the Parr calorimeter on 23 coals of commercial grades from the Jellico, Lafollette, Coal Creek and Oliver Springs districts. The samples were collected and prepared by the author, but the long exposure in the method of grinding used must have resulted in appreciable loss of moisture.

W. F. HILLEBRAND.

**Cobaltite Occurring in Northern Ontario, Canada.** By JUSTIN

S. DELURY. *Am. J. Sci.* **21**, 275-276, figure.—This mineral occurs in quartz, associated with a little chalcopyrite and pyrite, in the southeastern part of Coleman Township, and this is its first authentic discovery in America. The forms observed are the cube and octahedron, usually in combination. Analysis afforded: Co, 29.10; Fe, 4.55; Ni, 0.97; As, 44.55; S, 20.73.

W. F. HILLEBRAND.

**Sixth Annual Report of the Chief of the [Philippine] Mining Bureau.** By H. D. McCASKEY. 66 pp.; maps, plates.—Appended to the general administrative report are the following reports of reconnaissance work by members of the staff. *Narrative Report of Benguet Field Work*, by A. J. EVELAND, pp. 42-43; *Narrative Report of Work in Batan Island, Albay*, by W. D. SMITH, pp. 44-47; *Report upon the Bulacan Iron Industry*, by MAURICE GOODMAN, pp. 48-56; *Report upon Building Stone near Manila*, by H. M. ICKIS, pp. 57-66. The last contains a translation from the Spanish, with analysis, of a report on the weak mineral waters of Bombongan, Pagsanjan, Laguna. The water contains chiefly bicarbonates of calcium, magnesium and iron, with some sulphates and chlorides.

W. F. HILLEBRAND.

**Black Sands of the Pacific Slope.** *Senate Document No. 65, 59th Congress, 1st Session*, 24 pp.—This is a report by the Director of the Geological Survey, through the Secretary of the Interior, communicating to the Senate all information thus far gathered relating to the examination and utilization of the black sands with special reference to discovering a new source of platinum. In it are included two preliminary reports by Dr. D. T. Day, in charge of the investigation. One of these has already been noticed in these pages (this Journal, **27**, R 653). His second report (Exhibit C) "reviews the experiments in concentration that have been conducted at the Lewis and Clark Centennial Exposition at Portland, Oregon. . . . Two sharp conclusions have been established: (1) That 95 to 98 per cent. of the precious metals, gold and platinum, are obtained in the first inch and a half on the surface of a Wilfley table; (2) that more than a ton of concentrates is obtained for every 100 tons of sand passed once over the table." The mineral composition of some sands and of many concentrates is given.

W. F. HILLEBRAND.

**[Gases Occluded in Andesite and Pyroxene from Red Mountain, Arizona.]**—In a paper entitled "Red Mountain, Arizona; A Dissected Volcanic Cone," by W. W. ARWOOD, in *J. Geol.* **14**, 138-146, are given two analyses of the gases extracted from an andesite and its included pyroxene crystals. The rock furnished 6.37 times its own volume of gas and the pyroxene 1.11 volumes. The gases from the rock contained:  $H_2S$ , 0.01;  $CO_2$ , 80.38; CO, 9.02;  $CH_4$ , 4.72;  $H_2$ , 1.84;  $N_2$ , 4.00; total, 99.97. Those from the



pyroxene were composed of:  $\text{H}_2\text{S}$ , 8.90;  $\text{CO}_2$ , 62.62;  $\text{CO}$ , 14.46;  $\text{CH}_4$ , 1.30;  $\text{H}_2$ , 7.01;  $\text{N}_2$ , 5.71; total, 100.00.

W. F. HILLEBRAND.

**Pisolitic Barite.** BY HERMAN WUESTNER. *J. Cincinnati Soc. Nat. Hist.* 20, 245-250; plate.—In boring for oil at Saratoga, Hardin County, Texas, there were blown out by gas from a depth of 1350 feet several barrels of pellets of a mineral substance which has been shown to consist largely of barium sulphate. Nowhere else in that region has a similar occurrence been noticed. The peculiarity consists in the pisolitic form, now observed for the first time with respect to barite. Among the pellets were a few fragments of reef-building coral, which also consist mainly of barite. The pellets have been formed around fragments of the coral as a nucleus. It is suggested that the pellets are the product of a confined locality, and were formed by a subterranean spring carrying barium sulphate in solution, much as the pisolitic aragonite of Carlsbad is supposed to be formed. A transverse section of the pellets shows tubes radiating from the nucleus, embedded in two or three encrusting concentric layers, which are in turn enclosed by a series of cortical layers. Analyses by S. Waldbott are:

	Shell.	Nucleus.	Coral.
Vol. hydrocarbons.....	0.77	0.98	1.62
Volatile at red heat.....	0.23	2.10	3.08
$\text{BaSO}_4$ .....	92.73	90.86	90.00 (about)
$\text{CaSO}_4$ .....	3.31	2.74	undet.
$\text{SrSO}_4$ .....	1.36	1.02	none
Iron, unburned carbon..	1.60	2.30	.....
	100.00	100.00	

Sp. gr. of pellets, 3.99.

W. F. HILLEBRAND.

**Some Phosphorescent Calcites from Fort Collins, Colo., and Joplin, Mo.** BY WM. P. HEADDEN. *Am. J. Sci.* 21, 301-308.—The author's data were obtained with the Missouri mineral, which shows the stronger phosphorescence. The property of glowing for a considerable period of time, in some cases as long as thirteen hours, after exposure to the sun, is peculiar to the yellow calcite; ordinary calcite under like conditions phosphoresces for one-third of a second, and aragonite for twenty seconds. The glow is strongest where the color is deepest; in a specimen partly yellow and partly white, purple, or colorless the phosphorescence is coextensive with the yellow portion. The yellow calcite emits light when crushed or powdered. Phosphorescence is induced also by the electric spark, by the X-ray, by magnesium light, or by heating. Ignition or solution destroys the property. The phosphorescence does not affect the photographic plate. Analysis

of a yellow calcite from Joplin, Mo., gave:  $\text{SiO}_2$ , 0.032 per cent.;  $\text{CO}_2$ , 43.950 (100 grams gave 10 cc. of gas not absorbed by  $\text{KOH}$ );  $\text{SO}_3$ , trace;  $\text{H}_2\text{S}$ , none;  $\text{P}_2\text{O}_5$ , trace;  $\text{Cl}$ , trace;  $\text{CaO}$ , 55.740;  $\text{SrO}$ , trace;  $\text{MgO}$ , 0.113;  $\text{MnO}$ , 0.045;  $\text{FeO}$ , 0.046;  $\text{ZnO}$ , 0.014;  $\text{Al}_2\text{O}_3$ , trace;  $\text{Cr}_2\text{O}_3$ , trace;  $\text{Ce}_2\text{O}_3$ , 0.007;  $\text{Di}_2\text{O}_3$ ,  $\text{Sm}_2\text{O}_3$ ,  $\text{La}_2\text{O}_3$ , 0.012;  $\text{Y}_2\text{O}_3$ ,  $\text{Er}_2\text{O}_3$ , 0.013;  $\text{NH}_3$ , trace;  $\text{Na}_2\text{O}$ , trace; total, 99.975. The solution of the ceric oxides in hydrochloric acid shows an unknown spectroscopic line. There are also certain persistent peculiarities in the chemical behavior, particularly of the oxalates of the yttria group. The total amount of rare earths is sometimes greater in a non-phosphorescent than in a phosphorescent calcite, but in the latter the oxides of the yttria group are relatively more abundant than in the former; the white opaque calcite contains less zinc oxide and much less of the rare earths than the yellow phosphorescent material. Lines in the absorption spectrum of purple calcite the author identifies with the  $\alpha$  and  $\beta$  lines of didymia, and he thinks didymia probably responsible for the color of the calcite. "The analytical results justify the inference that the yttrium group has a greater influence on the phosphorescence of the calcite than the cerium group," and this inference is strengthened by the presence of didymia in the purple portions, which do not phosphoresce. "Our failure to detect any organic coloring-matter suggests very strongly that we are to find the cause of the phosphorescence in the presence of some element whose salts are yellow. My interpretation of the facts is that they point to the yttrium group or some member of it, whether it is at present known to chemistry or not, as the cause of this property."

E. C. SULLIVAN.

**A New Occurrence of Pseudo-Leucite.** By C. W. KNIGHT. *Am. J. Sci.* **21**, 286-293.—On Spotted Fawn Creek, Yukon Territory, pseudo-leucite crystals were found which contain orthoclase, scapolite, nephelite, biotite, and a very little plagioclase. Scapolite has not heretofore been observed. The author suggests that the original crystal was a soda leucite, that after the entire magma had solidified the leucite changed over into orthoclase, nephelite, and subordinate plagioclase, and that still later the nephelite changed partly into scapolite. An analysis is given; the composition is similar to that from other localities.

E. C. SULLIVAN.

**The Re-formation of Soda-Leucite.** By T. T. READ AND C. W. KNIGHT. *Am. J. Sci.* **21**, 294-295.—On the hypothesis that the change of leucite into pseudo-leucite took place as the mass cooled (see preceding review) the authors attempt to reverse the transformation by heating pseudo-leucite above the temperature at which the original reaction occurred. Heating at the highest temperature of a Bunsen flame five and one-half hours produced

no change. At 1225° for ten hours some isotropic substance, possibly glass, was formed. No biotite or scapolite could then be detected. The former appeared to have migrated to the border of the crystal. At 1100° for eight hours results similar to those at 1225° were obtained: biotite melted without migration. At this point the work was broken off. E. C. SULLIVAN.

**Sedigenetic and Igneogenetic Ores.** BY H. FOSTER BAIN. *Economic Geology* I, 331-339.—The two classes of ores are compared as to tonnage and value of total production in this country:

	Sedigenetic.		Igneogenetic.	
	Short tons.	Value.	Short tons.	Value.
Iron .....	259,371,403	\$3,473,824,157	\$35,382,651	\$473,888,190
Copper.....	1,734,414	426,008,000	2,667,564	655,169,200
Lead.....	1,625,135	130,010,800	5,495,431	430,634,480
Zinc .....	1,085,036	97,653,340	150,001	13,500,090
Silver .....	.....	.....	75,530	1,430,374,026
Gold .....	.....	.....	4,353	2,603,286,360

E. C. SULLIVAN.

**The Southern Klondike District, Esmeralda County, Nevada.—A Study in Metalliferous Quartz Veins of Magmatic Origin**

BY JOSIAH EDWARD SPURR. *Economic Geology*, I, 369-382.—Close to the contact of an intrusive granitic mass with limestone and following the outline of the intrusion so faithfully as to show a definite genetic connection with it, is a quartz vein which near the surface carries sporadic high values in silver (chiefly in the form of the chloride), with some gold. Stetefeldtite (?), galena, pyrite, siderite, calcite, hematite, and wad are accessory minerals. The granitic rock varies in composition in different portions; "the segregation may be explained by the assumption of relatively slight viscosity of the magma, which property has permitted strong currents to bring about the migration and massing of like materials." Orthoclase has crystallized from the magma where fluorine was scanty, muscovite where it was abundant. "The ore deposits appear to be due to the action of the same residual silicious magmatic waters and gases which have played so important a part in the consolidation of the intrusive rock." Rock analyses by W. F. Hillebrand and E. T. Allen accompany the paper. E. C. SULLIVAN.

**The Virginia Copper Deposits.** BY WALTER HARVEY WEED AND THOMAS LEONARD WATSON. *Economic Geology*, I, 309-330.—The only productive properties thus far have been those of the Virgilina District, where glance and bornite occur in quartz fissure veins which intersect or lie in an altered andesite containing chiefly chlorite, epidote, and hornblende. Cuprite, malachite, and a little native copper are found also. The gangue



mineral is principally quartz, with calcite and epidote. In the Blue Ridge Region, in the northern part of the State, the ores are chiefly cuprite and native copper with small amounts of the carbonates and still less of bornite and chalcopyrite. They occur with some calcite, feldspar, and asbestiform serpentine along crevices and joint-planes in small lenses of quartz and as disseminated grains through the altered basalt which forms the country rock. They are found only where the rocks are fractured and epidotized, and have resulted from concentration of material leached from the surrounding rocks. In the Southwest Virginia Region the primary ores are cupriferous pyrrhotite with disseminated chalcopyrite. The main country rock is mica schist, the immediate wall rock sericite schist. Associated minerals are calcite, muscovite, and biotite, with hornblende and talc in some localities. The sulphides are later than these and at some points the process was largely one of replacement. Secondary enrichment, with formation of chalcocite, has played an important part in these deposits. Rock analyses by T. L. Watson are given.

E. C. SULLIVAN.

**Recent Publications on Alaska and Yukon Territory.** By ALFRED HULSE BROOKS. *Economic Geology* **1**, 340-359.—For the most part a review of papers published by the United States and Canadian Geological Surveys during the past year.

E. C. SULLIVAN.

**The Secondary Enrichment of Copper-Iron Sulphides.** By THOMAS T. READ. *Bi-monthly Bull. Am. Inst. Min. Eng.* 1906, pp. 261-267.—Contributions from the Department of Mineralogy, Columbia University, Vol. 10, No. 11. Four experiments are described on the action between chalcopyrite and solutions of (1) copper sulphate and sulphurous acid, (2) copper sulphate, (3) sulphurous acid, and (4) calcium bicarbonate. The chalcopyrite was more or less attacked in each case. The work is seriously defective in that there are grave discrepancies in the analyses reported. In one experiment, according to the figures given, solid and solution together contain finally 13.7 per cent. more iron and 1.4 per cent. less copper than originally, in spite of closely stoppered bottles. The author's errors of measurement are in fact greater in some cases than the things which he sets out to measure, viz., the quantities of copper and iron exchanged between the chalcopyrite and the solutions. Conclusions drawn from such work are of course valueless. The author is in error in assuming that sulphuric acid attacks chalcopyrite to any considerable extent under ordinary conditions. Also he should know that it is very far from established that chalcopyrite is a union of ferrous and cupric compounds.

E. C. SULLIVAN.

**The Geology and Petrography of the Goldfield Mining District, Nevada.** BY JOHN B. HASTINGS AND CHARLES P. BERKEY. *Bi-monthly Bull. Am. Inst. Min. Eng.* 1906, pp. 295-314; figures.—The ore bodies occur in hornblende-dacite and hornblende-andesite, in rhyolite, and in pyroxene-andesite. There is extreme silicification of these rocks along fractures generally northerly and southerly, and the rich ores have been found intimately associated with the resulting reefs. Derivation from ascending hot magmatic and vadose waters is indicated.

E. C. SULLIVAN.

**Summary of the Mineral Production of Canada for 1905.** BY ELFRIC DREW INGALL. *Geol. Survey, Canada, Section of Mines*, 1906, 16 pp.

E. C. SULLIVAN.

**The Structural and Industrial Materials of California.** ISSUED UNDER THE DIRECTION OF LEWIS E. AUBURY, STATE MINERALOGIST. *Bull. 38, California State Mining Bureau*, 412 pp.; maps, illustrations.—Describes in detail the occurrences of building stones, clays, and miscellaneous materials.

E. C. SULLIVAN.

**Iron Ore Reserves.** BY CHARLES KENNETH LEITH. *Economic Geology*, 1, 360-368.—Considering the possibility that each continent must ultimately depend on its own iron ore resources, the author concludes that the time of exhaustion for North America "is not likely to come before that calculated on the same basis for the world's reserves, and probably not then."

E. C. SULLIVAN.

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## ANALYTICAL CHEMISTRY.

**The Technical Analysis of Fluorspar.** *Chem. Eng.* 3, 2, 65.—A direct and an indirect method are given for the rapid determination of fluorine. In the direct method the fluorspar is mixed with powdered quartz and heated to 160° with concentrated sulphuric acid for about an hour. The silicon tetrafluoride evolved is passed into a solution of potassium chloride in 50 per cent. alcohol where potassium fluosilicate is precipitated and hydrochloric acid is set free. The free hydrochloric acid is then titrated with standard sodium hydroxide solution. The indirect method depends upon the fact that calcium fluoride is not attacked by acetic acid while calcium carbonate is dissolved. The fluorspar is treated with acetic acid and the undecomposed residue filtered and washed and decomposed by evaporating to dryness with sulphuric acid. The calcium is extracted from the decomposed residue by hydrochloric acid and is determined by the oxalate method in the usual manner. The fluorine is calculated by finding the amount necessary to form  $\text{CaF}_2$  with the calcium

determined above. Extreme accuracy is not claimed for these methods but they are rapid and yet accurate enough for technical purposes. A scheme is also given for the complete analysis of fluorspar, including determinations of  $\text{CaO}$ ,  $\text{MgO}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SiO}_2$  and  $\text{F}$ .

L. F. HAWLEY.

**Tests for Paints.** By J. R. MOECHEL. *Chem. Eng.* 3, 2 (1905).—Chemical tests reveal the composition of a paint but do not show whether it is suitable for the purpose for which it is intended, nor whether it will resist destructive agents. Hence for practical purposes, physical tests are necessary. The tests are made on plates of glass, wood, tin sheeting, galvanized iron, sheet steel, etc., cut one inch by three inches. These are painted with the paint to be tested and allowed to dry for just eight days at room temperature. Immersion for twenty-four hours in 10 per cent. sulphuric, nitric and hydrochloric acids gives an idea of the acid-resisting qualities of the paint. In addition 25 per cent. acids may be used, and the test may be repeated at  $100^\circ$ , in which case the time of immersion should be two hours. Exposure for three minutes to the fumes of the three acids heated to boiling, gives an indication of the resistance of the paint to acid fumes. Other painted plates are immersed in sodium hydroxide (10 per cent. and 25 per cent.) for fifteen minutes and examined after an hour's standing. The effect of ammonia is noted after five minutes' exposure to the gas; with sulphur dioxide and hydrogen sulphide the time of exposure is thirty minutes. Steam under pressure is allowed to act on the painted surface for one hour. Twelve hours' exposure to steam not under pressure as from a water-bath will have no effect on lasting paints but those of poor quality will blister and crumble under this treatment. The spreading capacity and covering quality are tested by painting weighed plates until the desired effect is produced, noting the number of coats required and the weight of each coat. In this way the amount of paint required per square foot is determined and the number of coats necessary. Protection afforded against rust is judged from the following test: Pieces of sheet iron, four inches by four inches, are carefully cleaned and polished, painted and allowed to dry. A second coat is applied and allowed to dry eight days. The plates are placed, paint downward, on a boiling water-bath for twelve hours, dried with filter-paper and heated in a water-oven at  $100^\circ$  for one hour. The paint can be removed after cooling and if the paint is of poor quality, the polished metal surface will be covered with rust. Good paints will dry in from twelve to eighteen hours. Paint is dry when a strip of good writing-paper can be laid on the painted surface and taken up without any paint adhering. Elasticity can be tested by painting strips of tin sheeting, which are bent after the paint is dry. The penetrating powers of paints in wood are compared



by examining, with a magnifier, cross-sections sawed out of painted strips. To determine whether a paint prevents the absorption of moisture, one inch cubes of the material to be painted are dried in a water-oven for three hours, painted with one, two or three coats, allowing each coat to dry thoroughly and then boiled in water for at least thirty minutes. They are weighed after drying with blotting-paper and the increase in weight is due to moisture absorbed. The fineness of the pigment is observed by allowing the paint to run down a glass surface. Color comparison can be made with absolute accuracy by placing the two colors side by side on a microscopic slide, pressing down with a cover glass and examining under the microscope. Glass, wood or metal plates coated with the paint are exposed to various temperatures to determine the effect of heat on the paint. Of course, it is not often that all of these tests need to be applied, but they require just as much care as any chemical analysis.

T. G. DELBRIDGE.

**Repairing Platinum Ware.** By ERNEST J. SWEETLAND. *Eng. Min. J.* 80, 1163.—An interesting method of repairing platinum ware consists in welding a piece of heavy platinum foil, used as a patch, upon the article in question. A non-conducting block, of the proper curvature for use as an anvil, is made by filling the dish, previously greased, with a mixture of pumice stone and plaster of Paris. "The block is now rigidly mounted in a convenient position and the dish is placed over it with the cleaned surface to be repaired upward. A piece of heavy platinum foil of the proper size to cover the hole is cut and kept in readiness. With the blast-lamp in the right hand and the small piece of platinum held with a pair of forceps in the left, turn the flame upon the spot to be repaired; when this becomes white hot, bring the patch into the flame until it is also white hot. Now, while both parts are heated to incandescence, bring them firmly together with the forceps. The flame may now be removed and the parts examined to see if the patch has been put in the proper position; if so, the flame is again turned on, and while white hot the patch is gently tapped all around with any convenient tool. A small three-cornered file which has been rounded on its untempered end answers the purpose admirably." B. S. CUSHMAN.

**Colorimetric, Turbidity, and Titration Methods Used in Soil Investigations.** By OSWALD SCHREINER AND GEORGE H. FAILYER. *Bull.* 31, *Bureau of Soils, U. S. Dept. of Agr.*—The apparatus used and the procedure followed in obtaining water extracts of soils free from coloring-matter and suspended particles is described. Detailed descriptions are given of well-known and newly devised methods for determining small quantities of ammonium, potassium, magnesium, manganese, iron, titanium,

nitrate, nitrite, phosphate, silica, sulphate, sulphide, calcium chloride, carbonate and bicarbonate.

J. H. PETTIT.

**Some New Apparatus.** BY S. F. ACREE. *Am. Chem. J.* **35**, 309-316.—A new form of alkali apparatus is described. The apparatus is of the bottle type with bulb inside. The principal new features consist in the use of glass wool in the apparatus. The potassium hydroxide solution saturates the glass wool in such a way that a very large surface is exposed for the absorption of carbon dioxide. As a test of the efficiency, carbon dioxide was passed during fifteen minutes into two bulbs in series. The first bulb increased nearly 1 gram, while the second bulb did not gain as much as 0.10 mg. Thus, the time of an organic combustion may be shortened by the increased rate of absorption of carbon dioxide. A porcelain-lined bomb is described which is serviceable for many purposes in the laboratory. The porcelain lining is made of acid- and alkali-proof material. An apparatus for rapid precipitation in electrolytic analysis is a third new form. It consists essentially of a round platinum gauze electrode, 2.5 inches in diameter, which is used in conjunction with a rotating electrode of a propeller-like form. This rotating propeller forces the solution down against the gauze electrode, and causes a continuous circulation of the electrolyte. A more rapid precipitation of the metal results. The cost of such a gauze is much less than the ordinary platinum dishes used, and has the advantage that it may be quickly cleaned dried and weighed, and may be used for rapid precipitation with quite dilute solution, if the rotating electrode is used at the same time.

LAUDER W. JONES.

## METALLURGICAL CHEMISTRY.

**Mineral and Metal Production in 1905.** *Eng. Min. J.* January 6, 1906, p. 2.—This is the usual estimate of the mineral and metal output of the United States in the previous year, which is such a feature of the New Year's issue of this Journal. The metal output is estimated:

		Values.
Pig iron.....	23,010,625 long tons	\$382,666,694
Copper .....	462,634 short tons	145,257,798
Gold.....	4,178,592 oz. Troy	86,337,700
Silver.....	58,938,355 " "	37,437,643
Lead .....	322,587 short tons	30,368,340
Zinc .....	199,964 " "	23,523,765
Aluminium....	6,000 " "	4,200,000
Mercury .....	30,256 flasks	1,173,932

Total, \$710,965,872

J. W. RICHARDS.

**Coke-making in the United States.** BY E. W. PARKER. *Iron Age*, January 4, 1906. The author estimates that the Connelsville bed will be exhausted in twenty-five to thirty years. He states that 3,635 by-product coke-ovens are now in operation, 1,255 of the Semet-Solvay type and 2,380 of the United-Otto type.

J. W. RICHARDS.

**Iron Manufacture in Mexico.** BY J. BIRKINBINE. *Iron and Steel Mag.* January, 1906, 1-7.—Some phenomenal deposits of iron ore have so far been utilized on only a moderate scale. The supply of fuel is deficient, and restricted rainfall in many parts causes a deficit of water. The labor is good, fairly reliable and initiative, at wages of one-tenth to one-half those paid in the United States. The conditions are favorable for a moderate development of existing iron and steel industries, so that they shall keep pace with the development of the country.

J. W. RICHARDS.

**Electric Smelting at Portland.** *Iron Age*, Jan. 4, 1906.—Later results obtained in the electric smelting of magnetite sand concentrates show 55 per cent. of iron obtained, and 14 pounds of steel produced per day per horse-power used, comparing favorably with German and Canadian results.

J. W. RICHARDS.

**Production of Steel Rails and Bessemer Ingots in 1905.** *Iron Age*, February 8, 1906, p. 509 (from *Bull. Am. Iron and Steel Association*).—The total Bessemer steel production in the United States in 1905 is given as 10,941,375 gross tons, an increase of 39 per cent. over 1904. Of this, 20,784 tons were made by Tropenas and small converters. Steel rails were produced to the total amount of 3,372,257 gross tons, an increase of 47.6 per cent. over 1904. Of this, open-hearth rails were 183,264 tons, or 5.5 per cent.; Alabama was the leading state in the latter development.

J. W. RICHARDS.

**Blast-furnace Gases for Electric Power.** BY H. FREYN. *Iron Age*, December 28, 1905. (Read before the Western Society of Engineers.)—Calculations are given on an assumed output of 800 tons of pig-iron daily, yielding 4,350,000 cubic feet of waste gases per hour, with a total combustible value of 391,500,000 B. T. U., and capable of generating, if all used in gas-engines, 43,500 horse-power or over 50 horse-power per ton of pig-iron produced per day. About 30 per cent. of this gas must be used, in fire-brick stoves, for heating the blast. The blast required averages 90 cubic feet per minute per ton of pig-iron produced per day, which must be furnished at 15 to 18 pounds pressure per square inch, running at times up to 30 pounds, requiring a maximum of 9 horse-power per ton of iron made per day. To wash the gas for the engines, Theisen washers are the best and most



economical, cleaning to 0.3 gram of dust per cubic meter of gas. These would require, to clean all the gas, 1.25 horse-power per ton of iron produced per day, or a power production of 1.50. Losses of gas may be put at 5 per cent. The operation of pumps, lifts, etc., would require 1.5 horse-power per ton of iron produced. The summary is:

	H. P.	H. P.
Total theoretical horse-power <i>per ton of iron per day</i>		50.0
Gas used in stoves, equivalent to.....	16.7	.....
Power for blowing engines.....	9.0	.....
Power for auxiliary machines.....	1.5	.....
Power for gas-washers.....	1.5	.....
Loss of gas, equivalent to.....	2.5	31.2
Available for outside purposes.....		18.8

The cost of 10,000 horse-power gas engines is given at \$42.40 per horse-power, gas cleaning plant and piping \$7.00, or in round numbers, \$50.00 per horse-power complete. The operating costs, including interest, amortization, etc., and valuing the blast-furnace gas at 1 cent per 1,000 cubic feet, are put at \$17.88 per brake horse-power year.

J. W. RICHARDS.

**Open-hearth Furnace Comparisons.** By A. D. WILLIAMS, JR. *Iron Age*, December 7, 1905.—The average amount of natural gas used by open-hearth furnaces in the Pittsburgh district, including gas to heat ladles, is 7,000 to 13,000 cubic feet per ton of steel made, costing 5 to 8 cents per 1,000 cubic feet and having a calorific value of 900 to 1,000 B. T. U. per cubic foot (8000 to 8900 calories per cubic meter). The fuel consumption of furnaces using producer gas varies from 450 up to 1,000 pounds per ton of steel. Gas mains should have one-eighth the grate area of the producers. Losses of gas at the reversing valves often reach 10 to 20 per cent. Producers gasify 8 to 16 pounds of coal per hour per square foot of grate area, according as they are forced. A rule of thumb is to make the producer grate area 3.5 square feet for each ton of furnace capacity; it varies at eight different plants from 2.84 to 6.24. The stacks used are 4 to 6 feet internal diameter and 100 to 160 feet high, for 20 to 50 ton furnaces. The area of the gas valve is 80 per cent. that of the air valve, and the combined area 60 to 70 per cent. of the stack area. The flues from valves to stack should be 25 per cent. greater than the stack area. Gas ports have areas of 3 to 10 square feet, air ports 12 to 18.

J. W. RICHARDS.

**Open-hearth Castings.** By W. M. CARR. *Iron and Steel Mag.* January, 1906, 30-40. (From *The Foundry*, December, 1905.)—The first of a series of articles on the acid and basic open-hearth processes. The charge is usually pig-iron and scrap, the hearth silica sand containing over 95 per cent. silica, the fuel

preferably natural gas, used without preheating, crude petroleum or residuum low in sulphur, or producer gas; the final additions are 80 per cent. ferro-manganese and 50 per cent. electric furnace ferro-silicon (0.003 to 0.010 sulphur and 0.04 to 0.06 phosphorus); the iron ore preferably magnetites or hard hematites, high in iron and moderately low in phosphorus (0.05 to 0.10 sulphur and 0.03 to 0.50 phosphorus). The molding sand is as near pure silica as possible, with sharp irregular grains (98.5 per cent. silica), mixed with sufficient refractory but plastic fire-clay to bond it (low in alkalis, carbonate of lime and not over 3 per cent. iron oxide). The basic furnaces use pig-iron with 1.00 per cent. silicon, 0.05 sulphur, and 1.00 phosphorus; 50 to 75 per cent. of the sulphur present, and 95 per cent. of the phosphorus can be eliminated. The hearth is calcined magnesite carrying 90 to 95 per cent. magnesia; for points above the slag line, calcined dolomite carrying 50 to 55 per cent. lime and 37 to 45 per cent. magnesia is used; where cutting is severe, chrome ore is used carrying 40 to 60 per cent. chromic oxide. Ordinary limestone is used as flux, the purer the better; fluorspar is added to thin a limy slag. To produce 1 net ton of castings there is required, on an average:

	Acid practice.	Basic practice.
Pig iron.....	620 pounds	1,227 pounds.
Steel scrap.....	1,880 "	1,227 "
Ferro-silicon .....	54 "	57 "
Ferro-manganese.....	28 "	35 "
Iron ore .....	26 "	30 "
Chrome ore.....	..	5 "
Aluminium .....	0.3 "	0.3 "
Limestone.....	..	300 "
Dolomite .....	..	85 "
Fluorspar.....	..	13 "
Magnesite ....	..	34 "
Silica sand.....	1,800 "	1,600 "
Fire-clay .....	300 "	350 "
Gas coal.....	950 "	1,250 "
Fuel oil.....	55 gallons	80 gallons
Boiler coal (power).....	900 pounds	900 pounds

J. W. RICHARDS.

**Blast-pressures in the Cupola.** BY W. H. COLEMAN. *Iron Age*, November 30, 1905.—Most cupolas are run with insufficient tuyere area and too high blast-pressure, thus producing large loss of silicon and manganese in melting the iron. The total tuyere area should be 20 per cent. of the inside diameter of the cupola; the supply pipe should not have less than one-third the area of the tuyeres. With these conditions, and a proper blower of large capacity, an equal melting capacity can be obtained with

3 to 5 ounces less blast-pressure, and with the production of soft castings easy to machine.

J. W. RICHARDS.

**Experimental Desulphurization.** BY R. MEEKS. *Iron Age*, November 9, 1905.—Good coke being scarce, it was necessary to use coke in the cupola running as high as 1.5 per cent. sulphur. To counteract this, it was decided to use limestone abundantly, and a charge was used of 4400 pounds pig-iron, 425 pounds coke and 400 pounds of limestone. Test bars showed a decrease of sulphur in the castings of only 0.005 per cent., while the lining of the cupola was badly cut. Next manganese ore (40 per cent. manganese) was used, but with equally poor results. Use of ferro-silicon in the ladle, and ferro-manganese in the charge, gave equally negative results. The writer's conclusion is that sulphur cannot be satisfactorily eliminated in the cupola, but may be reduced somewhat by liberal use of ferro-manganese in the reservoir ladle.

J. W. RICHARDS.

**Alkali-resisting Alloys.** BY J. JONES. *Metal Industry*, February, 1906.—The best alloy for machinery which comes in contact with soap, washing-soda, bluing or starches is stated to be cast iron with from 1 to 10 per cent. of nickel added, the metal being poured hot. Alloys containing zinc, tin, lead, aluminium, antimony or silicon are especially subject to corrosion by caustic alkali.

J. W. RICHARDS.

**Injurious Effect of Acid Pickles on Steel.** BY C. F. BURGESS. *Electrochem. and Metal. Ind.* January, 1906, 7-11.—A discussion of the influence of such treatment on the physical properties of the metal. Tests were made on the amount of flexure which a steel strip or wire would stand before and after being pickled, the stress being applied by a low-pitch screw, whose turns measured the deflections. Results are stated in percentage of deterioration, as measured by the falling off of the deflection producing rupture, after immersion, compared with the previous deflection. Sulphuric acid is found to produce less brittleness than hydrochloric, and nitric acid more than either, without, however, removing scale as satisfactorily. Arsenic in the solution, as arsenious acid, is a great preventative of the brittleness; it causes almost complete suppression of gas, and reduces the percentage of deterioration 85 to 98 per cent. of that normally occurring in a sulphuric acid solution. In hydrochloric acid the benefit is less pronounced. Tin, antimony or bismuth in solution act in the same direction as arsenic, but not so efficiently. Samples tested by pickling and nickel-plating afterwards were found to have an average deterioration of 11.85 per cent. when cleaned simply by emery, 15.58 per cent. when pickled in ordinary sulphuric acid solution, and only 6.8 per cent. when pickled in the same containing



arsenious oxide. The conclusion is that the brittleness or "rotting" of iron and steel is due to the penetration of hydrogen into its pores, rather than of acid; but this cannot be avoided, since the evolution of hydrogen is necessary to loosen the scale. The best way to treat steel is to temper it without forming scale on it, by immersing it in melted lead covered by melted borax. The sand blast is also preferable to acid pickling, wherever it can be used.

J. W. RICHARDS.

**Copper Mining in 1905.** BY H. J. STEVENS. *Iron Age*, January 4, 1906.—The copper production of the United States in 1905 is estimated as 471,500 short tons, an increase of 14 per cent. over 1904. The principal increase is in Arizona (24 per cent.) and in Montana (12 per cent.).

J. W. RICHARDS.

**Production of Copper in 1905.** BY F. HOBART. *Eng. Min. J.* January 6, 1906, 4.—The United States, Mexico and Canada have increased production largely; in Europe there has been little change. Of the 413,066 long tons estimated produced in the United States, Montana furnished 150,893 (36 per cent.), Arizona 102,678 (25 per cent.), Michigan 101,563 (24 per cent.) and Utah 25,566 (6 per cent.).

J. W. RICHARDS.

**The De Lamar Copper Refinery.** BY O. PUFÄHL. *Eng. Min. J.* January 13, 1906, 73-74.—The blister copper averages 99 per cent. copper, 140 ounces of silver and 0.25 to 1 ounce of gold per ton. The plant treats 3600 tons monthly. It is melted in reverberatory furnaces handling each 75 tons per twenty-four hours, at a cost of \$1.50 per ton, and cast into anodes  $27 \times 35 \times 2$  inches, weighing 350 to 400 pounds. The slags from these furnaces are smelted with limestone and pyrite residues in a shaft furnace to 80 per cent. metal, which is returned to the melting furnaces, and matte which is worked up separately. The electrolytic plant contains 816 cells, holding 15 anodes each, grouped into two systems of 12 sets of 34 baths each. Electrodes are in multiple, tanks in each of the 12 sets in series. Main currents 6500 amperes at 115 volts in one system, and 5500 amperes at 115 volts in the other. Copper leads  $4\frac{3}{4} \times 1\frac{1}{2}$  inches; current density 15 to 17 amperes per square foot; voltage 0.3 per tank; electrolyte contains 40 grams copper and 140 cc. sulphuric acid per liter; working temperature  $52^{\circ}$  to  $57^{\circ}$ . Finished cathodes weigh 155 to 165 pounds. The electrolyte circulates at the rate of 20 liters per cell per minute. Anode scrap 12 per cent. The slimes are boiled with strong sulphuric acid with addition of some potassium nitrate, filtered, dried, melted on a magnesite hearth in a furnace fired by petroleum residue at the rate of 4500 pounds in thirty-six hours to 95 per cent. silver bullion, which is subsequently parted by sulphuric acid.

J. W. RICHARDS.

**The Perth Amboy Plant of the American Smelting and Refining Company.** BY O. PUFAHL. *Eng. Min. J.* January 27, 1906, 169.—The silver ore from South America is crushed and roasted in reverberatory furnaces from 26 down to 3 per cent. sulphur, then mixed with rich galena from Idaho, pyrites cinders, etc., and smelted to matte in shaft furnaces, using 12 per cent. coke, with blast 35 ounces per square inch, at the rate of 100 to 140 tons in twenty-four hours. Crude copper is refined in an electrolytic plant comprising 2 systems of 408 vats each, producing 3,200 tons of refined copper monthly. Each system is run by a dynamo furnishing 4,700 amperes at 105 volts. The cathodes grow for fourteen days; the anode scrap is 15 per cent. The lead is refined in 4 reverberatory furnaces of 60 tons capacity each, desilverized in 5 kettles of 60 tons capacity each, and again refined in 5 furnaces of 60 tons capacity. The zinc crusts are distilled in 18 Faber du Faur tilting furnaces, 1,200 pounds of crusts being distilled in six to seven hours, using 50 gallons of petroleum residues. Seven magnesia-lined cupel furnaces work up 5 tons of retort metal each in twenty-four hours, using 3 tons of coal. The Moebius silver refining plant contains 144 cells, in 24 groups of 6 each, the electrolyte containing 10 per cent. free nitric acid, 17 grams of silver and 35 to 40 grams of copper per liter. Current used 260 amperes per cell, at 1.75 volts. Yield 1,600 ounces of silver per twenty-four hours per kilowatt of current used. Daily production 100,000 ounces of silver. About \$3,000,000 worth of metal is in process of treatment in all the departments.

J. W. RICHARDS.

**Season Cracking of Brass and Bronze Tubing.** BY E. S. SPERRY. *Brass World*, February, 1906, 39-44.—Season cracks are those forming in metals or alloys some time after being manufactured into shape. Analysis of the metals reveals no cause for the trouble. They run lengthwise of tubes, and not transversely like crystallization cracks. Season cracks rarely occur in anything but tubes or rods, and then principally in high brass. They are confined also to cold-worked metals, and seem therefore to result from fatigue of the metal and crystallization combined. Too rapid reduction in drawing is the principal proximate cause, and this occurs mostly in articles finished upon the hydraulic bench, whose enormous power overstrains the metal far past its elastic limit. Too heavy reductions in cold-drawing are the cause of all the trouble.

J. W. RICHARDS.

**Mixtures for Turbine Wheels.** BY J. JONES. *Metal Industry*, January, 1906.—Manganese bronze is unsuitable because of its high shrinkage, producing porous spots on the castings. A manganese bronze wheel showing tensile strength of 66,845 pounds per square inch, elastic limit 33,104 pounds, and 35.5

per cent. elongation in 2 inches, lasted in service only a few months. From analyses of bronze wheels which have stood up well, the mixture now adopted by a prominent firm contains copper 100 parts, tin 10, zinc 4, lead 1.25, poured cool. The physical tests of a coupon from these castings should show tensile strength 40,000 pounds, elastic limit 18,800, elongation in 2 inches 38 per cent. Wheels made of this bronze, although inferior in strength to manganese bronze, are much less liable to shrinkage spots and porous areas, and wear several years with very little change except to take on the color of old gold.

J. W. RICHARDS.

**Tests of the Rockwell Melting Furnace.** By W. S. QUIGLEY. *Metal Industry*, October, 1905. (Read before the Pittsburgh Foundrymen's Association).—Bronze melted in this furnace averaged 1,665 pounds tensile strength and 210 pounds elastic limit, per square inch, stronger than similar metal melted in crucibles in a coke fire. The loss of metal was 3.18 per cent., cost of melting \$3.36 per short ton; in crucibles loss 3.25 per cent., cost \$5.18.

J. W. RICHARDS.

**Tests of the Steele-Harvey Crucible Melting Furnace.** By W. T. KRAUSE. *Metal Industry*, October, 1905. (Read before the Pittsburgh Foundrymen's Association).—Comparative tests with this furnace using oil, and ordinary crucibles in coke fires, showed, in melting brass, average losses of 1.06 per cent. and 2.8 per cent., respectively, costs 13.4 cents and 33.3 cents per 100 pounds.

J. W. RICHARDS.

**Improvements in Nickel-Copper Smelting.** *Eng. Min. J.* December 16, 1905.—A. Monell carries on the Thompson process of smelting with sodium sulphate on the hearth of a reverberatory furnace lined with magnesite brick, instead of in a shaft furnace. A charge of nickel-copper-iron matte is mixed with about 60 per cent. of its weight of sodium sulphate (salt cake), and with 15 per cent. of coke, and a 50-ton charge melted down on the hearth and kept melted for four or five hours after fusion has occurred, during which time it is poled. Nearly complete solution of the copper-iron sulphides by the sodium sulphide is thus obtained in one or at most in two operations, whereas several are required when the smelting is done rapidly in a shaft furnace.

J. W. RICHARDS.

**Copper-Lead Eutectic.** By E. S. SPERRY. *Brass World*, March, 1906, 100.—Extra pains were taken to obtain the easiest melting alloy or mixture of lead and copper, liquating from a 50 per cent. copper lead alloy. After several liquations, the eutectic was found to contain 2.42 per cent. copper.

J. W. RICHARDS



**Copper Smelting vs. Lead Smelting.** BY J. W. MALCOLMSON. *Eng. Min. J.* November 25, 1905. (Read before the American Mining Congress).—The author explains how the scarcity of lead ores in Mexico is leading to the substitution of copper ores as collectors of gold and silver in smelting operations. A lead charge can carry only one-third its weight of silica, a copper charge one-half; a greater concentration can be obtained with copper matte without greater losses in the slag; a furnace of the same size can put through twice the tonnage on matte smelting. The author predicts that the copper ores of the northern part of Mexico will be shipped south, to smelt the gold and silver ores, thus producing rich copper to be refined, and saving all around.

J. W. RICHARDS.

**Production of Gold in 1905.** BY F. HOBART. *Eng. Min. J.* January 6, 1906, 1-3.—The production of the world, in 1905, is estimated to be \$375,465,810, of which the Transvaal furnished \$101,295,960 (27 per cent.), Australia \$85,522,125 (23 per cent.), United States \$86,337,700 (24 per cent.); of the latter item, Colorado furnished \$25,333,300 (30 per cent.), California \$17,502,600 (20 per cent.) and Alaska \$14,650,100 (17 per cent.).

J. W. RICHARDS.

**Production of Silver in 1905.** BY F. HOBART. *Eng. Min. J.* January 6, 1906, 1-2.—Of the total \$35,952,397 estimated produced in the United States, Montana furnished \$8,235,000 (23 per cent.), Colorado \$7,750,000 (22 per cent.), Utah \$7,320,000 (21 per cent.), Idaho \$5,490,000 (12 per cent.), Nevada \$3,660,000 (10 per cent.) and Arizona \$2,074,000 (6 per cent.).

J. W. RICHARDS.

**Cyanidation during 1905.** BY C. H. FULTON. *Eng. Min. J.* January 13, 1906, 76-78.—The cyanide process has been more largely used for silver ores, as at the Butters plant on the Comstock Lode in Nevada. The experience gained shows it to require much longer than treatment of gold ores, some ten to twenty-five days, that more thorough oxidation and aeration of solutions is required, and solutions of 0.5 to 2 pounds of cyanide per ton are used, which are up to 3 times as strong as for gold ores; the consumption of cyanide is larger, 2 to 4 pounds per ton, but the precipitation by zinc threads or dust is perfectly satisfactory, with no greater consumption of zinc. Concerning gold ores, the Merrill filter-press, which can be flushed out by water under pressure without opening, is a great improvement, and is being rapidly introduced. Crushing of ores in cyanide solutions is becoming more general, also very fine grinding, which gives better extractions. The mixed potassium sodium cyanide is in general preferred to the pure sodium cyanide.

J. W. RICHARDS.

**Sulphur in Roasting Gold Ores.** BY W. E. GREENAWALT. *Eng. Min. J.* December 23, 1905.—Sulphur remaining in roasted gold ore is not objectionable in the chlorination process, if present as sulphate of alkaline or alkaline earth metals. Such sulphates are not attacked by chlorine, but sulphur remaining as sulphides is attacked, and gives rise to serious losses of chlorine. Some forms of pyrite are more difficult to roast than others; unoxidized ores from the deeper levels of a mine are harder to roast than the partly oxidized ores on the surface, even though the sulphur contents are similar. On some Cripple Creek ores, carrying 2.75 per cent. sulphur, the best extraction is frequently made by chlorination when the roasted ore contains 0.6 to 0.8 per cent. sulphur; in others, when it contains 0.3 to 0.5. In all these cases, the sulphur as sulphate, soluble in water, is the larger part, and insoluble sulphur only 0.03 to 0.10 per cent. Tests of ore in three furnaces showed 86 to 92 per cent. of the sulphur evolved to be driven off in the first 70 feet; after that, the chief change is insoluble sulphur becoming soluble. The soluble sulphur may be 0.6 to 0.9 per cent., and good results still be obtained in chlorination, if no iron sulphate is present; the insoluble sulphur should be reduced to at most 0.1 per cent. for good chlorination.

J. W. RICHARDS.

**Babbitt Metal and Its Manufacture.** BY E. S. SPERRY. *Brass World*, March, 1906, 75–83.—The original babbitt metal was 50 parts tin, 5 antimony, 1 copper. Great variations, principally by introducing lead or zinc, have been made, so that there are three classes of these white bearing metals sold to-day; viz., “genuine babbitts,” in which tin predominates, with 5 to 10 per cent. of antimonial lead usually present; “antifriction metals,” in which antimonial lead is the chief constituent; “white brasses,” containing zinc in excess. Of the first class, there is the standard, the hard and the soft, composed as follows:

	Standard genuine.	Hard genuine.	Soft genuine.
Tin.....	90	88	84
Antimony .....	7	4	6
Copper .....	3	8	3
Twenty per cent. antimonial lead..	—	—	7

The addition of more hard lead than 7 per cent. is not advised, for the naive reason that “the color and fracture are then such that the customer becomes suspicious” (!) Nickel, manganese or iron is of no advantage to these genuine babbitts, zinc and magnesium are injurious, a fraction of a per cent. of aluminium removes the yellow surface coloration, phosphorus does likewise and thins the metal. Of the second class, lead with 15 per cent. of antimony is the best; 5 per cent. of tin in addition improves its looks but not its wearing qualities. Mixtures intermediate between these and genuine babbitts are also used, such as lead 50,

tin 40, antimony 10, with very satisfactory results. White brasses are not described in the article. J. W. RICHARDS.

**Lead in 1905.** BY W. R. INGALLS. *Eng. Min. J.* January 6, 1906, 9-10.—The greatest development in the metallurgy of lead in 1905, in the United States, was the introduction of the Huntington-Heberlein process into the plants of the American Smelting and Refining Co. Of the total output in the United States, (311,550 short tons) about two-thirds is desilverized lead and one-third soft lead. J. W. RICHARDS.

**Zinc in 1905.** BY W. R. INGALLS. *Eng. Min. J.* January 6, 1906, 12-14.—The year was marked by high prices, high production and shortage in ore supply. The output in Silesia increased 4,000 tons and in the United States 18,000 tons, reaching nearly 200,000 tons altogether. The increase in the United States was chiefly in the Western smelters, and mostly from ore imported from British Columbia and Mexico. Metallurgically, the chief advance is the addition of a certain proportion of carborundum to the clay in making the retorts, which is highly beneficial. Attempts are being made to line the retorts with a layer of carborundum, and thus use less of that expensive material. The zinc first distilling from the retorts is lower in lead than the average and commands a higher price, but may contain as high as 0.4 per cent. of cadmium, which does not act injuriously on brass except in a few special cases. J. W. RICHARDS.

**The Zinc Industry of the Rocky Mountain Region.** BY W. C. SWART. *Eng. Min. J.* December 9, 1905. (Read before the American Mining Congress.)—The only successful zinc concentrating plants in operation in this region are those using magnetic separators or static electric separators. There are 12 such plants in operation, with a daily capacity of about 430 tons, producing about 215 tons of concentrates carrying 45 per cent. of zinc. It is expected to double this output in 1906. J. W. RICHARDS.

**Electrogalvanizing.** *Brass World*, March, 1906; 85-88.—A solution of 2 pounds zinc sulphate to 1 gallon water, with the addition of 4 ounces of aluminium sulphate to brighten the deposit is recommended. The bath is let stand twenty-four hours, with the anodes in, before using, to neutralize any acidity. Castings of iron or steel should be first pickled by hydrofluoric acid or cleaned by sand blast. Machined articles are first dipped in the benzene bath, then in the potash kettle, then in the hydrochloric acid pickle, and finally in nitric acid till gas appears, then quickly into hydrochloric acid again, rinsed, and put at once into the plating bath. The anodes are either cast or rolled zinc; potential



required 6 volts. The process is very cheap, and is extensively used for a large variety of articles.

J. W. RICHARDS.

**Use of Cadmium in Sterling Silver.** *Brass World*, February, 1906, 64-65.—The oxide of copper, formed during melting, impregnates the metal and makes it look badly when worked and polished. Aluminium, phosphorus, manganese, silicon, zinc, and magnesium have all been tried as deoxidizers, but unsuccessfully. Cadmium is the most satisfactory addition yet found; it reduces the copper oxide, alloys well with silver, so that up to 20 per cent. the alloy rolls as well as sterling silver itself, so that any excess of cadmium used does not harm the alloy. It whitens the silver, probably by the complete removal of copper oxide; even 0.5 per cent. does this perceptibly. In practice, 0.5 per cent. is put into the melted metal just before pouring, being held in tongs under the surface. For castings in sand or plaster of Paris, 0.1 per cent. may be used.

J. W. RICHARDS.

**Tinning Solution for Brass or Copper.** *Brass World*, February, 1906, 25-48.—The bath consists of water 1 gallon, caustic potash 12 ounces, tin chloride (tin salts) 4 ounces, used in a cast-iron kettle, steam-jacketed preferred. The solution does not act on iron or steel. Brass works the quickest. The articles are cleaned from grease, small articles are put into a brass basket. Granulated tin or tin sheets are put in the bottom of the bath, and the articles rest on or touch these. A light tin coating forms in one minute, five to ten minutes gives sufficiently heavy deposits on brass, copper takes about twice as long. A temperature of 150° to 200° F is most satisfactory. Chloride of tin must be occasionally added. Polished articles come out with a lustrous surface almost like nickel-plating.

J. W. RICHARDS.

**Reviving Thick Tin by Use of Phosphor Tin.** *Brass World*, January, 1906, 26.—During the tinning operation, oxide of tin forms a mushy material on the surface of the bath, and the latter also becomes thickened from dissolving tin oxide. Two ounces of phosphor tin to 100 pounds of this thick tin will quickly liquefy the bath; too much must not be used. The oxide of phosphorus formed rises to the surface as a thinly liquid slag.

J. W. RICHARDS.

**Tin Dross.** *Brass World*, January, 1906, 23-24. A mixture of metallic tin, tin oxide, dirt, and oxides of lead, copper and antimony. Assays show it to contain 10 to 90 per cent. of tin.

J. W. RICHARDS.

**Aluminium Production.** *Iron Age*, January 4, 1906. The Pittsburgh Reduction Company has contracted with the Niagara Falls Hydraulic Power and Manufacturing Co., to supply an additional 27,000 horse-power, in 1907. The company will build a structure

600 feet long to house the new plant, which will more than double the company's output.

J. W. RICHARDS.

**Pin Holes in Aluminum Castings.** *Brass World*, January, 1906, 19-21.—If the metal is heated too high in the furnace, it absorbs gases and the castings are full of pin-holes; if poured too dull, blow-holes appear in the casting, due to entangled air. The best way is to have the top of the crucible project into the air, so that the heating gases cannot get to the metal. A graphite crucible is used, the largest pieces of metal are placed in the bottom, no fine scrap metal is used and it is not necessary to fill around the crucible with coal. When the last of the charge is melted, remove the cover, add gates and small material gradually, and when all is melted take out of the fire. The crucible being hotter than the metal, it should be allowed to cool off a short time, or else cooled by adding more metal, else it will be poured too hot. The whole secret lies in avoiding overheating.

J. W. RICHARDS.

**Aluminum Silver.** *Brass World*, March, 1906. A strong, white metal, much used for parts of typewriters, where it has replaced steel forgings and malleable iron castings, is made up of copper 57 per cent., nickel 20, zinc 20, aluminium 3. The copper and nickel are melted under charcoal, using 2 per cent. of borax as flux; then the aluminium is introduced, the metal cooled nearly to the setting point, and the zinc added. It is cast and remelted before final use. Only the purest metals should be used. The alloy is very stiff, does not tarnish, and can replace steel in many instances.

J. W. RICHARDS.

**Electrodeposition of Platinum.** By W. C. ARSEM. *Brass World*, March, 1906, 100.—A bath is made up as usual, with ammonium chlorplatinat dissolved in sodium citrate solution (Boettger's method), with a small amount of sal ammoniac added to increase the conductivity. The articles to be plated are used as poles of an alternating current, by which firm, adherent deposits are obtained. It will appear strange to electroplaters to deposit on both poles. The solution must be continuously replenished with the double chloride.

J. W. RICHARDS.

**Price of Rare-Earth Ores.** By C. S. PALMER. *Eng. Min. J.* January 13, 1906, 79.—Vanadium ore, 3 to 5 per cent.  $V_2O_5$ , \$500 per ton; tungsten ore, 70 per cent.  $WO_3$ , \$280 per ton; molybdenum ore, 90 to 95 per cent.  $MoS_2$ , \$450 per ton; tantalum ore, 22 per cent.  $Ta_2O_5$ , \$440 per ton; uranium ore, carnotite, 3 to 5 per cent.  $U_3O_8$ , \$400 per ton; pitchblende, 50 per cent.  $U_3O_8$ , \$1,500 per ton. The use of these rare metals in special steels is rapidly increasing.

J. W. RICHARDS.

**Chimney Draft and Forced Draft.** BY J. W. RICHARDS. *Electrochem. and Metal. Ind.* February, 1906, 55-59.—A discussion of the dimensions and working of chimneys, particularly for metallurgical purposes, with calculation of a chimney for a puddling furnace and the power available by substituting forced draft and passing the hot chimney gases through a steam boiler.  
J. W. RICHARDS.

**The Effect of Altitude upon Combustion.** BY C. M. PALMER. *Eng. Min. J.* January 20, 1906, 134-135.—Calculations are given of the relative amounts of fuel needed to attain a given temperature in a fireplace or blast-furnace, at sea-level and at high elevations, say 7,500 feet, and the conclusions are drawn that the diminished concentration of oxygen requires 28 per cent. more fuel, if blast at two pounds pressure is used, and 33 per cent. more fuel if natural draft is used. There is no room in this *Review* to properly discuss the matter, but readers are advised that the principle of discussion adopted and the conclusions based thereon are erroneous and unreliable.  
J. W. RICHARDS.

**Graphite Crucibles : Their Use and Abuse.** BY E. S. SPERRY. *Brass World*, January, 1906, 3-11.—Best graphite crucibles are made of Ceylon graphite and clay from Klingenberg, Germany. Their fracture should be fibrous, like wood. All crucibles should be carefully dried before using, otherwise they scale off when put in the fire. It should be annealed, by raising gradually to a red heat in a new fire, placing it upside down until red hot. The first heat needs the most care. When the crucible is about half worn out, pin holes frequently develop from which metal slowly oozes into the fire; they are probably minute fissures in the clay. Squeezing crucibles too hard with the tongs shortens their life materially; 4 to 5 times as many heats are obtained from crucibles in tilting furnaces, where they are never lifted out. Tongs are frequently very poorly shaped. Oil furnaces require softer crucibles.  
J. W. RICHARDS.

**Refractory Uses of Bauxite.** BY A. J. AUBREY. *Electrochem. and Metal. Ind.* February, 1906, 52-53.—Crude bauxite is washed to remove some free silica sand, then calcined at 1400° C. (2500° F.), by which it loses its water and undergoes great shrinkage, the greater part of the shrinkage occurring between 1300° and 1400° C. This calcined product, from Arkansas bauxite, contained alumina 87.30 per cent., silica 6.40, titanite oxide 3.99, ferric oxide 1.43, moisture 0.88. It can be bonded by using fire-clay, water-glass or lime. As little as 4 per cent. of plastic fire-clay suffices. After drying, the bricks or tiles are burnt at high temperature. With less than 6 or 8 per cent. silica, the bricks are as durable as magnesite, in open-hearth furnaces. The hot



zone of Portland cement kilns lined with these bricks has lasted for ten months of continuous service. In lead-refining furnaces, they resist the slag better than any other. J. W. RICHARDS.

**Metallurgical Calculations ; Artificial Furnace Gas.** By J. W. RICHARDS. *Electrochem. and Metal. Ind.* January, 1906, 11-16.—Calculations respecting the production of producer gas using large excess of steam (Mond gas), the reactions in regenerators when such gas is preheated, the production of water gas, and two problems concerning the running and economy of a Dellwick-Fleischer water gas producer. J. W. RICHARDS.

**Electrochemical Calculations.** By J. W. RICHARDS. *J. Franklin Inst.* February, March, 1906.—A consideration of calculations involving the energetics of the electric current, principles of thermo-chemistry, Faraday's laws, electrolytic evolution of gas, Ohm's laws, resistance capacity of vessels determination of ohmic resistance, voltage drop at electrode surfaces, chemical work in mixed electrolysis, output in mixed electrolysis, rise of temperature of electrolytic baths, energy consumed in chemical work, and tables of the thermochemical constants of the elements when entering into combination in dilute solution. J. W. RICHARDS.

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## ORGANIC CHEMISTRY.

**On the Molecular Rearrangement of Unsymmetrical Diacylpseudothioureas to Isomeric Symmetrical Derivatives.** By TREAT B. JOHNSON AND GEORGE B. JAMIESON. *Am. Ch. J.* 35, 297-309.—By treating alkyl pseudothioureas,  $H_2NC(SR):NH$ , with the calculated amount of benzoyl chloride and potassium hydroxide, the unsymmetrical dibenzoyl derivatives,  $(C_6H_5CO)_2NC(SR):NH$ , were obtained. They are quite unstable, and change into the symmetrical isomers,  $C_6H_5CONHC(SR):NCOC_6H_5$ , when heated to their melting-points or when their alcoholic solutions are boiled. On treatment with alkali, they split off a molecule of benzoic acid, giving the monobenzoyl compound, and this explains why Wheeler and Merriam obtained only the monobenzoyl derivative when they treated pseudomethylthiourea with benzoyl chloride. They stated that they used an excess of alkali, which would, of course, change any dibenzoyl derivative to the monobenzoyl, as indicated above. The symmetrical dibenzoylpseudothioureas dissolve in alkali and are reprecipitated by acids unaltered. Boiling hydrochloric acid decomposes them with formation of symmetrical dibenzoylurea and mercaptan. On treating pseudomethylthiourea with *p*-brombenzoyl chloride and with anisyl chloride, mixtures resulted of the unsymmetrical and symmetrical diacyl derivatives, which, recrystallized from

alcohol, gave the pure symmetrical derivatives. **EXPERIMENTAL.** — *Unsymmetrical Dibenzoylpseudomethylthiourea*,  $(\text{C}_6\text{H}_5\text{CO})_2\text{NC}(\text{SCH}_3):\text{NH}$ . — Pseudomethylthiourea hydriodide was dissolved in cold water and mixed with one molecule of potassium hydroxide in concentrated aqueous solution. Benzoyl chloride and potassium hydroxide were then added alternately and gradually, and the solution kept cold. The precipitated dibenzoyl derivative was filtered out and washed with water and with ether. It melted at about  $130\text{--}135^\circ$ , resolidified, and then partially melted at  $145\text{--}146^\circ$  to a semi-solid which gradually decomposed on further heating and effervesced violently at  $175\text{--}185^\circ$ . By rapid cooling of its alcoholic solution, it was obtained in needles which showed the same behavior on melting. It was insoluble in alkali, but was decomposed thereby into benzoic acid and the monobenzoyl derivative. Boiled with hydrochloric acid, it was completely decomposed, benzoic acid being the only product isolated. Heated for twenty minutes at  $150^\circ$ , there was a slight evolution of methyl mercaptan, and the unsymmetrical compound changed to the symmetrical. *Symmetrical Dibenzoylpseudomethylthiourea*,  $\text{C}_6\text{H}_5\text{CONHC}(\text{SCH}_3):\text{NCOC}_6\text{H}_5$ , crystallizes from alcohol in long, slender needles, melting at  $147\text{--}148^\circ$ , and is also formed when an alcoholic solution of the unsymmetrical compound is boiled for a long time. It dissolves in 20 per cent. sodium hydroxide solution and is reprecipitated by hydrochloric acid. If boiled with hydrochloric acid, methyl mercaptan is evolved, and a practically quantitative yield of symmetrical dibenzoylurea results. *Unsymmetrical Dibenzoylpseudoethylthiourea*,  $(\text{C}_6\text{H}_5\text{CO})_2\text{NC}(\text{SC}_2\text{H}_5):\text{NH}$ , partially melted at  $104\text{--}105^\circ$ , re-solidified, and finally melted at  $110^\circ$ . When it was boiled for fifteen minutes with 20 per cent. hydrochloric acid, the monobenzoyl derivative, the symmetrical dibenzoyl derivative, and benzoic acid were produced. *Symmetrical Dibenzoylpseudoethylthiourea*,  $\text{C}_6\text{H}_5\text{CONHC}(\text{SC}_2\text{H}_5):\text{NCOC}_6\text{H}_5$ , is formed when the unsymmetrical dibenzoyl derivative is heated to its melting-point or when it is crystallized from 95 per cent. alcohol. It forms needles melting at  $110\text{--}111^\circ$ . *Symmetrical Di-p-brombenzoylpseudomethylthiourea*,  $\text{BrC}_6\text{H}_4\text{CONHC}(\text{SCH}_3):\text{NCOC}_6\text{H}_4\text{Br}$ , from *p*-brombenzoyl chloride and pseudomethylthiourea, crystallizes from alcohol in needles, m. p.  $178^\circ$ . (The unsymmetrical derivative was not isolated.) It was completely decomposed by sodium hydroxide solution, the only product isolated being *p*-brombenzoic acid. It was not changed by boiling with hydrochloric acid, but gave the *symmetrical di-p-brombenzoylurea* when boiled with hydrobromic acid. The latter decomposes with effervescence at  $228\text{--}233^\circ$ . *p*-Brombenzoylurea,  $\text{BrC}_6\text{H}_4\text{CONHCONH}_2$ , from urea and *p*-brombenzoyl chloride, is difficultly soluble in alcohol or water. It forms microscopic crystals melting at  $236\text{--}237^\circ$  with effervescence. *p*-Methoxybenzoylpseudomethylthiourea,  $\text{CH}_3\text{OC}_6\text{H}_4$

CONHC(SCH<sub>3</sub>):NH, from pseudomethylthiourea hydriodide and a benzene solution of anisyl chloride, forms colorless, slender prisms, m. p. 103-105°. *Symmetrical Di-*p*-methoxybenzoyl-pseudomethylthiourea*, CH<sub>3</sub>OC<sub>6</sub>H<sub>4</sub>CONHC(SCH<sub>3</sub>):NCOC<sub>6</sub>H<sub>4</sub>OCH<sub>3</sub>.—The reaction between pseudomethylthiourea and two molecules of anisyl chloride gave what was probably a mixture of symmetrical and unsymmetrical diacyl derivatives. On crystallizing the crude product from warm alcohol, the symmetrical isomer was obtained pure in needles, m. p. 159-160°. Boiled with hydrochloric acid, *symmetrical dianisylurea* (m. p. 205-207°) was produced.

M. T. BOGERT.

**On the Formation of Alcoholates by Certain Salts in Solution in Methyl and Ethyl Alcohols.** (Fifteenth communication.)

By HARRY C. JONES AND LEROY MCMASTER. *Am. Ch. J.* **35**, 316-326.—Jones and Getman have shown that when certain salts are dissolved in ethyl alcohol the rise in the boiling-point of the alcohol is abnormally great, and they interpreted this as due to combination between the dissolved substance and the solvent, *i. e.*, to the formation of alcoholates. In the present paper, this work is extended to other salts and to another non-aqueous solvent. The solvents used were anhydrous methyl and ethyl alcohols, and the salts were lithium chloride, bromide and nitrate, and calcium nitrate. The results are tabulated and show, as before, the formation of alcoholates in the solutions, the amount of alcoholates formed increasing with the concentration of the solution. The only exception was calcium nitrate in ethyl alcohol solution, which showed a steadily decreasing molecular rise in the boiling-point of the alcohol with increasing concentration. This behavior the authors ascribe to polymerization of the salt molecules. The composition of the alcoholates formed was not ascertained.

M. T. BOGERT.

**Relative Rates of Oxidation of Ortho, Meta and Para Compounds.** By HAMILTON BRADSHAW. *Am. Ch. J.* **35**, 326-335.

—The *o*-, *m*- and *p*-isomers of the following groups were used in the experiments: hydroxybenzoic acids, aminobenzoic acids, nitrophenols, nitranilines and toluidines. The rates of oxidation of these various isomers with potassium permanganate are tabulated. In alkaline solution, the rate of oxidation was uniformly most rapid with the meta compound and slowest with the para. When the neutral solution of the permanganate was used, the ortho compound was generally the one most rapidly attacked in the first stages of the oxidation. Dreyfus has shown that when the permanganate is used in acid solution, the rates of oxidation of similar compounds are ortho: meta: para.

M. T. BOGERT.

***o*-Sulphaminebenzoic Acid and Related Compounds.** By



HAMILTON BRADSHAW. *Am. Ch. J.* **35**, 335-340. *o*-Sulphaminebenzoic Acid,  $\text{HOOC}\cdot\text{C}_6\text{H}_4\text{SO}_2\text{NH}_2$ , crystallizes in plates or needles. Which form will separate does not, however, depend upon the amount of alkali used in hydrolyzing the benzoic sulphinide as claimed by Wilson. Nor does it depend upon the presence of unhydrolyzed sulphinide. Both forms of crystals lose water (with formation of saccharin) at the same temperature. What Wilson supposed to be the diamide,  $\text{H}_2\text{NCOC}_6\text{H}_4\text{SO}_2\text{NH}_2$ , is now proven to be the ammonium salt of the carbamine sulphonc acid,  $\text{H}_2\text{NCOC}_6\text{H}_4\text{SO}_3\text{NH}_4$ . The compound obtained by the action of phosphorus oxychloride upon potassium *o*-carbaminebenzenesulphonate is *o*-cyanbenzenesulphone chloride, and not *o*-carbaminebenzenesulphone chloride as stated by Wilson. With ammonia, it gives either the *o*-cyanbenzenesulphonamide,  $\text{NCC}_6\text{H}_4\text{SO}_2\text{NH}_2$ , or

pseudosaccharinamide,  $\text{C}_6\text{H}_4\begin{matrix} \diagup \text{C}(\text{NH})_2 \\ \diagdown \text{SO}_2 \end{matrix} \text{N}$ . The former of these

melts at  $160^\circ$  (uncorr.), and immediately changes to the pseudosaccharinamide (m. p.  $297^\circ$ , uncorr.). *Aniline-o-sulphonic Acid*,  $\text{H}_2\text{NC}_6\text{H}_4\text{SO}_3\text{H}$ , was obtained by the action of alkaline hypobromite upon potassium *o*-carbaminebenzenesulphonate at  $80^\circ$ . When the hypobromite was added rapidly to a cold solution of the carbamine the chief product was tribromaniline; when it was added slowly, the product was *p*-bromaniline-*o*-sulphonic acid.

M. T. BOGERT.

**Some Derivatives of Phenylglycocoll-*o*-Sulphonic Acid.** By HAMILTON BRADSHAW. *Am. Ch. J.* **35**, 340-346.—Phenylglycocoll-*o*-sulphonic acid was prepared from *o*-sulphanilic acid, and the corresponding *p*-brom derivative from acetanilide. All attempts to prepare from the latter a compound analogous to indigo failed. Several of the well-known indigo methods were used. EXPERIMENTAL.—*Aniline-o-sulphonic Acid*, was prepared from *o*-carbaminebenzenesulphonic acid as described in the foregoing review, or, better, from acetanilide by the Kreis method. *Phenylglycocoll-o-sulphonic Acid*,  $\text{C}_6\text{H}_4(\text{SO}_3\text{H})\text{NHCH}_2\text{COOH}$ . Attempts to condense aniline-*o*-sulphonic acid with chloracetic acid failed, but the desired acid was obtained by treating aniline-*o*-sulphonic acid with formaldehyde and hydrocyanic acid, saponifying the resultant nitrile by boiling with potassium hydroxide solution, and then adding sufficient hydrochloric acid to precipitate the difficultly soluble acid potassium salt. As *p*-bromaniline-*o*-sulphonic acid is an intermediate product in the preparation of aniline-*o*-sulphonic acid it was converted by similar treatment into *p*-bromphenylglycocoll-*o*-sulphonic acid, and the latter was used for most of the experiments. Its acid potassium salt crystallizes from water in needles, while the free acid forms flaky crystals. The carboxyl is quite easily esterified, but all

efforts to esterify the sulpho group proved futile. *Attempts at Condensation*.—The following reactions, analogous to those by which indigo is obtained, were carried out with *p*-bromophenylglycocoll-*o*-sulphonic acid: (1) The glycocoll was treated with fuming sulphuric acid, but the only effect was to remove the acetic acid and give *p*-bromaniline-*o*-sulphonic acid. (2) The acid potassium salt of the glycocoll was boiled with anhydrous sodium acetate and acetic anhydride, but no condensation occurred. (3) The acid potassium salt was heated at 200° with sodamide, and at 250° with sodamide diluted with potassium cyanide, but condensation again failed to occur.

M. T. BOGERT.

**On Derivatives of Formhydroxamic Acid and the Possible Existence of Esters of Fulminic Acid. II.** BY H. C. BIDDLE. *Am. Ch. J.* 35, 346-353.—In the action of potassium hydroxide upon methylchloroformoxime,  $\text{CH}_3\text{ON}:\text{CHCl}$ , a peculiar isonitrile odor is observed which the author thought at first indicated the presence of methyl fulminate. In examining the products of the reaction, however, no fulminic ester could be isolated, the substances formed being methyl diiminooxalate,  $\text{HN}:\text{C}(\text{OCH}_3)\text{C}(\text{OCH}_3):\text{NH}$ , methyl cyaniminocarbonate,  $\text{HN}:\text{C}(\text{OCH}_3)\text{CN}$ , and the potassium salts of hydrocyanic, cyanic and oxalic acids. Methyl diiminooxalate and methyl cyaniminocarbonate were also prepared by the method of Nef, by passing a rapid stream of chlorine through a solution of potassium cyanide in aqueous methyl alcohol. Both substances are formed by this process, and can be separated by fractional distillation under diminished pressure. *Methyl Cyaniminocarbonate* is a colorless, mobile liquid, b. p. 33-34° at 22 mm., of isonitrile odor, and is not very stable. *Methyl Diiminooxalate* crystallizes in colorless, transparent plates, m. p. 29.5-30.5°, of peculiar, sweetish odor. It is not quite so unstable as the cyaniminocarbonate.

M. T. BOGERT.

**Amine Derivatives of Mesoxalic Esters.** BY RICHARD SYDNEY CURTISS. *Am. Ch. J.* 35, 354-358.—By the action of dry ammonia gas upon a dry benzene solution of ethyl oxomalonate or dihydroxymalonate, in presence of fused zinc chloride, and at low temperature, *ethyl dihydroxyiminodimalonate*,  $\text{HN}(\text{C}(\text{OH})(\text{COOC}_2\text{H}_5)_2)_2$ , is produced. It crystallizes from ether in flat, rectangular tablets, which melt roughly at 103-105° when rapidly heated, with evolution of ammonia. The substance is quite stable in dry air, but readily loses its ammonia in presence of water, going back to the dihydroxymalonate again.

M. T. BOGERT.

**Cinnamylideneacetic Acid and Some of Its Transformation Products.** BY ARTHUR MICHAEL AND WIGHTMAN W. GARNER. *Am. Ch. J.* 35, 258-267.—The authors try to obtain

the following reaction in the course of a piece of work undertaken with a view to determine whether any evidence could be obtained bearing on the existence of more than two stereoisomeric forms in the homologues of cinnamic acid:



Cinnamylideneacetic acid,  $\text{C}_6\text{H}_5\text{CH}:\text{CHCH}:\text{CHCOOH}$ , was obtained, however, in place of a propiolic derivative. A study was then made of this reaction to determine whether the necessary rearrangement involved took place with the removal of the first molecule of hydrobromic acid or by the action of potassium hydroxide on a propiolic acid derivative. The above dibrom acid and its ester were treated with alcoholic potassium hydroxide under various conditions. At least two isomeric monobrom acids were obtained. The chief part of the reaction product in each experiment was a heavy oil containing bromine. Fine needles melting at  $67-75^\circ$ , and shown to be a monobrom acid, were also obtained when the acid dibromide and alkali were used in the proportion of 1 and 2 and the reaction allowed to proceed at room temperature. Cinnamylideneacetic acid was obtained in small amount by the action of alcoholic alkali on the mixture of the esters of the monobrom acids obtained from the acid dibromide. Repeating the experiment with the oil from the mother-liquor of the first gave another small amount of cinnamylideneacetic acid. No bromine-free body was obtained except this acid. These experiments show that the second atom of bromine is removed with difficulty and that the resulting product is of the nature of an acrylic and not a propiolic derivative. The mixture of monobrom acids gave small amounts of benzaldehyde on oxidation with potassium permanganate in neutral solution, in sodium carbonate solution, and in the presence of free alkali. A study of the oxidation of various aromatic acids with potassium permanganate showed that acids of the type  $\text{C}_6\text{H}_5\text{CH}:\text{C}(\text{R}).\text{COOH}$  invariably gave benzaldehyde in the presence of dilute sodium carbonate or strong potassium hydroxide solutions; that phenylacetic acid gave benzaldehyde with carbonate but not in the presence of much free alkali; that hydrocinnamic acid gave none in either case; and that  $\Delta^a$ -phenylpentenoic acid,  $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CH}:\text{CHCOOH}$ , gave a small amount of the aldehyde in the presence of free alkali but none when the free acid was oxidized. These facts seem to indicate that in the mixture of monobrom acids at least a part of the product has gone over to an acid whose unsaturated carbons are nearer to the phenyl than in the  $\Delta^a$ -acid and that the formation of cinnamylideneacetic acid results without the previous formation of a propiolic derivative.

V. J. CHAMBERS.



**Magnesium Permanganate as an Oxidizing Agent.** BY ARTHUR MICHAEL AND WIGHTMAN W. GARNER. *Am. Ch. J.* **35**, 267-271.—Magnesium permanganate was best prepared by the first method of Mitscherlich (Gmelin-Kraut: "Anorg. Chem." Vol. II, 527). The anhydrous salt is insoluble in chloroform, carbon tetrachloride, benzene, toluene, nitrobenzene, ligroin, ether, and carbon disulphide, and is without action on these compounds at ordinary temperature unless some solvent for the salt be added. It is soluble in aliphatic alcohols, esters, acids, ketones, and in pyridine. Methyl alcohol, glacial acetic acid, methyl and ethyl acetates, and pyridine are only slowly changed by the permanganate; the others are easily and in some cases violently oxidized. Glacial acetic acid and pyridine proved to be the two best solvents for oxidation experiments. In the first it is a powerful oxidizing agent, much stronger than the corresponding potassium salt. Benzene and its homologues and open-chain hydrocarbons such as hexane are readily oxidized to carbon dioxide even in the cold. Pyridine, on the other hand, exerts an inhibitory influence on the oxidizing action of the salt; compounds such as alcohol, ethyl acetate, and acetone are acted upon less easily if pyridine be added to their solutions.

V. J. CHAMBERS.

**The Acceleration of Certain Oxidation Reactions by the Use of Hydrocyanic Acid.** BY A. S. LOEVENHART. *Ber.* **36**, 130-134.—While hydrocyanic acid diminishes the catalysis of hydrogen peroxide by platinum and silver it increases the catalytic action of copper, iron, and their salts. According to the theory of Kastle and Loevenhart it should also increase the accelerating effect of copper compounds on oxidation processes with hydrogen peroxide. Such is found to be the case. The addition of a small amount of hydrocyanic acid to a mixture of hydrogen dioxide, formic acid and copper sulphate nearly doubles the amount of formic acid oxidized in a given time.

V. J. CHAMBERS.

**The Question of Isomerism and Tautomerism.** BY ARTHUR MICHAEL. *Ber.* **39**, 203-211.—A study of the preparation and properties of the isomeric forms of ethyl formylphenylacetate, oxalacetic acid and its esters, and of dibenzoylacetylmethane and a discussion of these facts showing that the old idea that the isomerism in these and like cases is due to asymmetric carbon or to an ethylene linkage is no longer tenable. Three forms of ethyl formylphenylacetate were prepared, an oil that slowly solidified to a solid, m. p. 50°, a solid melting at 98-100° and another solid, m. p. 60-90°, that appeared to be a mixture of the other two. The two solid isomers changed to the fluid one at about their melting-points, the lower melting one the more easily. All the isomers are enolic as is proven by the fact that they all combine with tertiary amines, a reaction shown to be characteristic of

enolic compounds. The two known forms of oxalacetic acid and a new modification of its methyl ester were obtained. The acid melting at  $152^{\circ}$  changed at  $100^{\circ}$  or even on standing in the air in part to a higher melting isomer so that the mixture melted at  $164-168^{\circ}$ . The higher melting modification, m. p.  $176^{\circ}$ , also gave this mixture under like conditions. All forms showed the same solubilities and their salts seemed identical. The known form of methyl oxalacetate melts at  $74-76^{\circ}$ . A new form was obtained melting at  $85-87^{\circ}$  and which was very sensitive to heat, changing above  $50^{\circ}$  to the ordinary form. They showed no difference in their chemical properties, and both are believed to be ketonic bodies. The ketonic form of dibenzoylacetylmethane, m. p.  $107-110^{\circ}$ , was obtained by Claisen by crystallizing the enolic form from dilute alcohol. A second ketonic form, m. p.  $147-149^{\circ}$ , was obtained by using a trace of acetic acid in the alcohol. This form was also gotten by a similar treatment of the ketonic form, m. p.  $107-110^{\circ}$ , and from the enolic form by treatment with acetyl chloride. Both the ketonic forms, on crystallization from methyl or ethyl alcohols, chloroform, or carbon tetrachloride give a precipitate, m. p.  $126-130^{\circ}$ , of a mixture of the ketonic forms and a mother-liquor containing the enolic form. Ethyl bromide gives a mixture melting at  $130-140^{\circ}$ , but the various forms can be crystallized unchanged from ethylene bromide if the temperature be kept below  $25^{\circ}$ . The new isomer is enolized by benzene. Of the two ketonic forms, the higher melting one is the more stable. Tertiary amines produce enolization in whole or in part. Triisobutylamine in most solvents enolizes the  $148^{\circ}$  ketonic form to a keto-enol mixture, but when petroleum ether is used as the solvent the change only goes to the  $110^{\circ}$  ketonic body. The theory that the isomerism in the keto-diacylsuccinic acid esters is due to the presence of asymmetric carbon is no longer tenable as the isomers show the same relation to each other as do the two ketonic forms of dibenzoylacetylmethane and the latter contains no asymmetric carbon. According to the van't Hoff hypothesis there should be only two isomeric enolic forms of formylphenylacetic ester and there are actually three. Also, ethylene stereoisomers show a considerable difference in their energy content while the energy content of these bodies is so nearly the same that they pass from one form to the other with great ease.

V. J. CHAMBERS.

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## BIOLOGICAL CHEMISTRY.

**The Cutaneous Excretion of Nitrogenous Material.** By FRANCIS GANO BENEDICT. *J. Biol. Chem.* 1, 263-271.—For abstract see this Journal, 28, R 165. In this abstract it was stated that severe muscular work caused an excretion of nitrogen

by the skin of 0.22 gram per day. The figure really obtained was 0.22 gram nitrogen per hour.

F. P. UNDERHILL.

**On the Stability of the Oxidases and Their Conduct toward Various Reagents.** BY J. H. KASTLE. *Bull. 26, Hygienic Lab. U. S. Public Health and Marine Hospital Service, Washington, 1-23.*—Of the fungi thus far examined, by far the greater number are rich in oxidases. At low temperatures, in the dark, glycerol extracts of certain fungi retain their oxidizing powers practically undiminished for four months. Certain others, which in the fresh state possess remarkable oxidizing powers, rapidly lose their power to effect the oxidation of guaiacum and aloin. The stability of the oxidases seems to be greatly influenced by the nature of the other substances with which they may be in contact; thus it is found that they are less stable in water than in glycerol. The stability of the aqueous solutions is largely determined by the nature of the antiseptic with which the solutions are preserved, chloroform and thymol having a more detrimental action than toluene. Certain of the oxidases may be precipitated from aqueous solutions by ethyl alcohol. Temperatures up to 80° are insufficient to render these substances inert. When fresh fungus (*Lepiota Americana*) is kept for some time in an atmosphere of hydrogen there are produced reducing substances sufficiently powerful to reduce guaiacum blue. The oxidase of *Lepiota Americana* is much more readily soluble in water than in any other solvent. In solution the oxidase is not destroyed by 40 per cent. formic aldehyde. While it does not dissolve in ethyl, amyl or allyl alcohol it is not destroyed by contact with these substances. It is soluble in glycerol and to some extent in toluene. Certain substances, like chloral hydrate, destroy the oxidase completely. Among the reagents for these oxidases are leucorosolic acid, ethylphenolphthalein, ethyltetrabromophenolphthalein (not very good) and aloin. With aloin it is necessary to employ fresh solutions of the reagent. Aloin is also an excellent reagent for the peroxidases. F. P. UNDERHILL.

**The Conduct of Phenolphthalein in the Animal Organism.** BY J. H. KASTLE. *Bull. 26, Hygienic Lab. U. S. Public Health and Marine Hospital Service, Washington, 23-30.*—Phenolphthalein, when injected into the peritoneal cavity of an animal (guinea pig), forms some conjugated compound which of itself gives no color reaction with caustic soda, but which is hydrolyzable by hydrochloric acid, yielding phenolphthalein as one of the products of the hydrolysis. The quantity of phenolphthalein which is reduced in the animal organism to phenolphthalin is negligible. Fluorescein behaves in a manner similar to phenolphthalein but is more readily absorbed and more toxic. With *o*-cresolsulphonphthalein the result was indefinite. Sulpho-



fluorescein behaves like phenolphthalein. The bacteria normally present in the urine of guinea pigs have the power of decomposing the phenolphthalein compound present in the urine. Ferments of the liver have not the power but saliva possesses the property to a slight degree.

F. P. UNDERHILL.

**The Toxicity of Ozone and Other Oxidizing Agents to Lipase.**

By J. H. KASTLE. *Bull. 26, Hygienic Lab. U. S. Public Health and Marine Hospital Service, Washington, 37-43.*—The substances tried which are non-toxic to lipase are silver nitrate, iodic acid, formic aldehyde, the cresols, hydrocyanic acid, potassium nitrite, and succinic acid. Those that are moderately toxic are mercuric chloride, chromic acid, copper sulphate, and perosmic acid. Those that are powerfully toxic are ozone, chlorine, bromine, sodium fluoride, succinic peroxide acid, iodine cyanide and potassium permanganate. The toxicity of iodine cyanide to lipase is increased by rise of temperature.

F. P. UNDERHILL.

**The Influence of Chemical Constitution on the Lipolytic Hydrolysis of Ethereal Salts.**

By J. H. KASTLE. *Bull. 26, Hygienic Lab. U. S. Public Health and Marine Hospital Service, Washington, 43-52.*—The structural difference between butyl and isobutyl radicals is without influence on the lipolytic action of ethereal salts. The acid radical in an homologous series of ethereal salts exerts a great influence on their hydrolysis by lipase, for example, the amount of propionate hydrolyzed by lipase in a given time is almost an exact mean between the several amounts of acetate and butyrate hydrolyzed during the same interval and under the same conditions of temperature, etc. Formates are hydrolyzed more rapidly than acetates, which is an exception. Introduction of a cyanogen radical into the molecule of an ethereal salt does not greatly alter its conduct towards lipase.

F. P. UNDERHILL.

**Preparation and Analyses of Some Nucleic Acids.**

(Communication 9.) **On the Nucleic Acid of the Kidney.** By J. A. MANDEL AND P. A. LEVENE. *Z. physiol. Chem.* **47**, 140-143.—The nucleic acid prepared from the kidney by the method of Levene yielded guanine adenine, thymine, cytosine, and levulinic acid.

F. P. UNDERHILL.

**The Cleavage of Gelatine.**

(Communication 4.) By P. A. LEVENE AND G. B. WALLACE. *Z. physiol. Chem.* **47**, 143-149.—In the tryptic digestion of gelatine inactive  $\alpha$ -prolin was separated. As a result of a fifteen months' tryptic digestion of gelatine glyocoll and an unknown substance giving the pyrrol reaction were obtained.

F. P. UNDERHILL.

**The Précipitability of Amino Acids by Phosphotungstic Acid**

By P. A. LEVENE AND W. BEATTY. *Z. physiol. Chem.* **47**, 148-151.—An investigation showing the precipitability, by phosphotungstic acid, of the amino acids commonly occurring in certain digestive mixtures.

F. P. UNDERHILL.

**Experiments to Determine the Influence of the Bromides of Barium and Radium on Protein Metabolism.** By W. N. BERG AND W. H. WELKER. *J. Biol. Chem.* **1**, 371-413.—Radium bromide appears to have but little definite influence upon nitrogenous metabolism of the dog when administered subcutaneously or by way of the mouth. After subcutaneous injection, radium (bromide), like barium, calcium, and similar elements, is eliminated per rectum. Elimination occurs speedily. The intestine seems to be the main channel of radium excretion. Radium bromide, whether introduced per os or subcutaneously, appears to be eliminated in slight amounts in the urine. It does not appear to be eliminated through the skin or in epidermal matter.

F. P. UNDERHILL.

**Glycocoll Picrate.** By P. A. LEVENE. *J. Biol. Chem.* **1**, 413-415.—Glycocoll can be separated from and analyzed in the form of its picrate from a mixture of digestion products.

F. P. UNDERHILL.

**A Study of Para-Aeth-Oxy-Phenyl-Camphoryl-Imid (Camphenal) as an Antipyretic.** By E. M. HOUGHTON. *Am. J. Physiol.* **15**, 433-444.—For abstract see this Journal, R 202.

F. P. UNDERHILL.

**The Chemical Composition of Medicinal Plants.** By EDWARD C. HILL. *N. Y. Med. J.* **83**, 659-662.

F. P. UNDERHILL.

**The Influence of Certain Antipyretics on Nitrogen Metabolism.** By H. MORGENBESSER. *N. Y. Med. J.* **83**, 760-762.—Sodium salicylate increases the total nitrogen of urine from 9 to 16 per cent. and urea from 8 to 18 per cent. Uric acid and xanthine bases are not increased. Ammonia appears to be greatly increased. Quinine decreases the total nitrogen, 13 to 19 per cent. and the uric acid and purine bases 40 to 50 per cent. The urea and ammonia are increased. Acetanilide increases total nitrogen in the urine 14 to 21 per cent. as are also the urea, uric acid, and ammonia.

F. P. UNDERHILL.

**A New Method for Indicating Food Values.** By IRVING FISHER. *Am. J. Physiol.* **15**, 417-433.—In general the new method is based upon calories per cent. instead of either weight or calories per ounce. For details the original article should be consulted.

F. P. UNDERHILL.

**Recent Advances in the Physiology of the Digestive Organs**

**Bearing on Medicine and Surgery.** BY WALTER B. CANNON.  
*Am. J. Med. Rev.* 131, 563-578. F. P. UNDERHILL.

**The Effect of Intravenous Injection of Solutions of Dextrose upon the Viscosity of the Blood.** BY R. BURTON-OPITZ. *J. Expt. Med.* 8, 240-245.—The viscosity of the blood is increased by small and decreased by larger quantities of *d*-glucose injected intravenously. Hyperglycaemia induced by painting the pancreas with adrenaline causes an increase in the viscosity of the blood. The experiments were performed upon dogs.

F. P. UNDERHILL.

**Effects of Intravenous Injections of Radium Bromide.** BY R. BURTON-OPITZ AND GUSTAVE M. MEYER. *J. Expt. Med.* 8, 245-252.—When radium bromide is injected intravenously into dogs, marked cardiac inhibition may be noted together with a decrease in the frequency and depth of respiration. While injections of radium bromide of 240 and 1000 activities proved fatal with only one exception, the radium bromide of 10,000 activity did not produce fatal results. The inference is drawn that the injurious effects of the radium bromide preparations used were due in a large measure to the accompanying barium salt.

F. P. UNDERHILL.

**The Photodynamic Action of Eosin and Erythrosin upon Snake Venom.** BY HIDEYO NOGUCHI. *J. Expt. Med.* 8, 252-268.—The haemolysins of the various venoms respond differently to photodynamic action, and they may, therefore, be regarded as possessing different chemical constituents. As regards stability cobra haemolysin ranks first, daboia second, and crotalus third. The toxicity of these venoms is more or less diminished by eosin and erythrosin in sunlight. This reduction in toxicity depends upon chemical changes taking place in certain of the active principles of the venom. The globulin-precipitating and blood corpuscle-protecting principle of cobra venom is relatively thermostable and in contradistinction to the immunity-precipitins it is also unaffected by eosin and erythrosin.

F. P. UNDERHILL.

**The Effect of Eosin and Erythrosin upon the Haemolytic Power of Saponin.** BY HIDEYO NOGUCHI. *J. Expt. Med.* 8, 268-271.—Solutions of saponin have their haemolytic power considerably reduced when exposed to sunlight in the presence of minute quantities of eosin and erythrosin.

F. P. UNDERHILL.

**The Formation of Glyoxylic Acid.** BY H. D. DAKIN. *J. Biol. Chem.* 1, 271-279.—Creatine and creatinine readily yield large quantities of glyoxylic acid on oxidation with hydrogen peroxide.



Smaller amounts are also obtainable from glycolic acid, sarcosine, betaine, and hippuric acid. A substance giving the reaction of glyoxylic acid is readily formed by the autoxidation of aqueous solutions of glycocoll, creatine and creatinine. Although small quantities of glyoxylic acid may be isolated from blood, liver, and muscle, from urine, and from culture media in which bacteria or molds have grown, it is not certain that it is a direct product of cell metabolism. The test proposed by Eppinger for the detection of glyoxylic acid in the urine is unreliable. The presence of traces of glyoxylic acid in the urine may be accounted for by the oxidation of creatinine. Addition of hydrogen peroxide to urine gives rise to the formation of a considerable quantity of glyoxylic acid.

F. P. UNDERHILL.

**On the Pyrimidine Bases of the Nucleic Acid Obtained from Fish Eggs.** By J. A. MANDEL AND P. A. LEVENE. *J. Biol. Chem.* **1**, 425-426.—A substance was prepared from fish eggs which had the general properties of a true nucleic acid except that in composition this acid was similar to the nucleic acid obtained from plant cells, which contains only two pyrimidine bases, uracil and cytosine.

F. P. UNDERHILL.

**Studies in the Chemistry of the Ion-proteid Compounds.** (Second Communication.) **II. On the Influence of Electrolytes upon the Staining of Tissues by Iodine-eosin and Methyl Green.** By T. BRAILSFORD ROBERTSON. *J. Biol. Chem.* **1**, 279-305.—The influence of various salts and of acids and alkalies upon the staining power of infusoria and of gelatine plates in iodeosin and in methyl green has been investigated. The various electrolytes exert a distinct and definite action upon the staining power in the above-mentioned dyes. In general, after treatment with electrolytes in which the transport number for the anion is greater than 0.5, the infusoria stain deeply in methyl green and faintly in iodeosin. After treatment with electrolytes in which the transport number is less than 0.5 the infusoria stain deeply in iodeosin and faintly in methyl green. There is a general parallelism between the staining power and the transport number of the electrolyte with which the tissue has been treated. The effects are not due, at least in their entirety, to alternations of permeability or to the hydrions and hydroxylions produced by the hydrolytic dissociation of the salts. The results are such as to lend support to the hypothesis of an unstable ion compound in protoplasm, the ion of which is readily replaced by other ions, the ion present in the greatest mass forming the greatest part of the compound, and the acid or basic properties of the compound being determined by the acid or basic properties of the ion. The salts of heavy metals which were investigated, as well as alkalies in the case of iodeosin and

acids in the case of methyl green, were exceptions to the rule of parallelism between staining power and transport numbers which was found in the case of infusoria which had been treated with other electrolytes.

F. P. UNDERHILL.

**Contributions to our Knowledge of the Chemistry of Carbamates.** BY J. J. R. MACLEOD AND H. D. HASKINS. *J. Biol. Chem.* **1**, 319-335.—Solutions of ammonium carbamate in water quickly decompose until a certain equilibrium between carbamate, carbon dioxide and total carbon dioxide and between carbamate ammonia, ammonia and total ammonia is established. Solutions of ammonium carbonate (sesquicarbonate) contain proportionately less carbamate than the above because of the acid carbonate which they contain. On standing for some time in a tightly corked flask the carbamate does not become less in amount. In fact it appears slightly to increase. The addition of ammonia to solutions of ammonium carbamate or carbonate decreases the carbamate content. The addition of small amounts of sodium carbonate to solutions containing the acid carbonate increases their carbamate content. The addition of excess of carbonate, of course, lowers the ratio of carbamate carbon dioxide to total carbon dioxide. The addition of sodium carbonate to fluids, such as the urine, which contain ammonium salts causes carbamate to be formed in relatively large amount. Therefore, stale urine and citrate urine contain carbamates. A solution of ammonium carbamate in ice-cold water depresses the freezing-point of water to a distinctly less extent than does the same solution after standing a few minutes at room or body temperature. This is accounted for by the conversion of carbamate (two ions) into ammonium carbonate (three ions). A method is also given for the preparation of pure calcium carbamate.

F. P. UNDERHILL.

**Factors Influencing Secretion.** BY JOHN BRUCE MACCALLUM. *J. Biol. Chem.* **1**, 335-345.—The conclusion drawn from this investigation is that there are three main factors in secretion acting in various glands: in the first place an activity in the gland somewhat similar to muscular contraction and governed in many cases by the same conditions; secondly, the force which is exerted by a quantity of blood passing through the organ, the secretion diminishing or increasing according to the shrinking or swelling of the organ (kidney), and in the third place, in both these classes of glands, changes in permeability play a rôle.

F. P. UNDERHILL.

**On the Polymerization of Globulin.** BY ALONZO ENGLEBERT TAYLOR. *J. Biol. Chem.* **1**, 345-355.—Two bottles containing globulins, one an insoluble globulin the other a soluble globulin,

were allowed to stand in water for eighteen months under antiseptic precautions. During this time the insoluble globulin exhibited a tendency to be in part transformed into soluble globulin while the soluble globulin showed a tendency to become insoluble. The reaction is reversible and tends toward an equilibrium in the system.

F. P. UNDERHILL.

**Studies on the Banana, I.** BY E. MONROE BAILEY. *J. Biol. Chem.* **1**, 355-363.—Experiments to discover the processes involved in the ripening of the banana are recorded. It is shown that ripening (the formation of soluble carbohydrates and the decrease of total carbohydrates) proceeds slowly if at all when the gaseous exchange is prevented by covering the skin with some inert substance, such as paraffin or a varnish. Deficiency or entire lack of oxygen causes a distinct inhibition of the ripening process. All attempts to demonstrate enzymatic action have failed.

F. P. UNDERHILL.

**Extreme Toxicity of Sodium Chloride and Its Prevention by Other Salts.** BY W. J. V. OSTERHOUT. *J. Biol. Chem.* **1**, 363-370.—Young plants of a fresh water alga, *Vaucheria sessilis*, which can live three to four weeks in distilled water, are killed in a few minutes by  $\frac{3M}{32}$  sodium chloride and in a few days by 10,000 sodium chloride. The toxicity of  $\frac{3M}{32}$  sodium chloride solution is inhibited by addition of calcium chloride in the proportion of 100 parts of sodium chloride to 1 of calcium chloride. The plants are able to develop normally and produce mature fruit in a  $\frac{3M}{32}$  sodium chloride solution to which have been added small quantities of magnesium chloride, magnesium sulphate, potassium chloride and calcium chloride, all of which salts are toxic when used singly.

F. P. UNDERHILL.

**On Gas Production by Fecal Bacteria Grown on Sugar Bouillon.** BY C. A. HERTER AND HERBERT C. WARD. *J. Biol. Chem.* **1**, 415-421.—It has been shown in this investigation that a somewhat diminished gas production is a not infrequent accompaniment of various digestive disorders.

F. P. UNDERHILL.

**The Production of Methyl Mercaptan by Fecal Bacteria Grown on a Peptone Medium.** BY C. A. HERTER. *J. Biol. Chem.* **1**, 421-425.

F. P. UNDERHILL.

**The Formation of Uric Acid.** BY LAFAYETTE B. MENDEL. *Am. Med. Association*, 1906, March 24 and 31.—A resumé of the literature to the present together with a presentation of some problems to be investigated.

F. P. UNDERHILL.



**The Carbohydrate Groups of Spleen Nucleoprotein.** (Communication I.) BY P. A. LEVENE AND J. A. MANDEL. *Z. physiol. Chem.* 47, 151-154.—Glucothionic acid was prepared from the spleen nucleoprotein. F. P. UNDERHILL.

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## PHARMACEUTICAL CHEMISTRY.

**Contributions of Pharmacology to Physiology.** BY PROF. HANS MEYER. *Science*, 22, 417, 1905.—The author treats in a very general way several physiological problems that have been elucidated by pharmacological methods. He states that formerly it was impossible to detect any physiological difference between centrifugal and centripetal nerve tracts, but Dixon, with cocaine, showed that they must be chemically different as they react differently to poisons. Langley, by means of nicotine, showed that preganglionic nerves were paralyzed, while post-ganglionic nerves were not affected. This made it possible to prove whether a nerve ends in a sympathetic ganglion or passes through. Tetanus toxin and strychnine were found to have different effects on the shortening of muscles, which led to the discovery of length regulating tonus centers in the spinal cord. "Wertheimer and Lepage were able to show that the pancreatic gland has at least two distinct mechanisms through which it is possible to excite secretion of pancreatic fluids; first, certain structures intimately connected with the vagus nerve, which may be excited by pilocarpine, physostigmine, or muscarine, or completely paralyzed by atropine; and secondly, another set of structures which are not acted on by these poisons, being neither excited or paralyzed by them, but which react to certain other definite chemical stimuli like secretin." The action of chemical or pharmacological agents first led to the discovery of various chemical reactions of organisms, oxidation and reduction, formation of hippuric acid in the kidneys, etc. Herter's studies show with what energy the muscles take up oxygen from oxyhemoglobin and other reducible substances. "Herter found that if animals receive intravenous infusions of methylene blue the pectoral muscles were soon colored deep blue, but that if during the experiment the excess of oxygen was hindered by giving the animal air mixed with carbon monoxide, the blue muscles in a few seconds recovered their natural red color, they had almost momentarily reduced the methylene blue to the colorless leucobase."

A. B. STEVENS.

**Some Reasons Why the Alkaloids Win.** EDITOR OF *The Alkaloidal Clinic*, 12, 1027 (1905).—The principal reason given is that crude drugs and preparations made from them, like fluid extracts, tinctures, etc., are variable and of uncertain action,

due to age, evaporation, etc., while the action of active principles like alkaloids is certain, and as the dose remains constant, the desired effect may be obtained with certainty.

A. B. STEVENS.

## AGRICULTURAL CHEMISTRY.

**Report of Food and Drug Laboratory.** BY H. E. BARNARD. *Bull. Indiana State Board of Health, Vol. 8, No. 1.*—The analytical results are given in tabular form, accompanied by a brief, popular discussion of the subject. The following table is given as a summary of the entire report:

FOODS.			
Articles examined.	Total number of samples examined.	Number of illegal samples.	Percentage of adulteration.
Butter .....	4	0	0
Canned fruits, jellies and jams .....	113	93	82.3
Cheese.....	1	0	0
Chocolate and cocoa.....	49	7	14.3
Coffee.....	23	8	34.8
Lard.....	2	1	50.0
Lemon extract.....	11	7	63.7
Maple syrup and sugar .....	54	49	95.8
Milk .....	14	6	42.8
Spices.....	248	108	43.5
Tomato catsup.....	62	54	87.0
Vanilla extract.....	9	3	33.3
Vinegar, cider.....	6	3	50.0
Vinegar, malt.....	1	0	00.0
Miscellaneous food products.....	3	3	100.0
Wines .....	20	17	85.0
Totals .....	620	359	57.9
DRUGS.			
Aqua ammonia.....	63	56	88.9
Glycerol .....	61	47	77.0
Tincture of iron .....	17	3	17.6
Miscellaneous drugs.....	5	2	40.0
Totals.....	146	108	73.3

W. D. BIGELOW.

**Report of the Examination of Food Products Sold in Connecticut.** BY A. L. WINTON, E. MONROE BAILEY, I. A. ANDREW, AND KATE G. BARBER. *Report Connecticut Agr. Expt. Sta. 1905, Part II.*—The report includes the results of a comprehensive series of samples of foods taken in the open market. The full detail of the analytical work is given in tabular form, accompanied by a discussion of the same. The samples examined are divided into three classes: those sampled by the Station; those sampled by health officers, consumers and dealers; and those sampled by the Dairy Commissioner. A tabular state-

ment of the results of the examination of each of these classes is given below.

## SUMMARY OF THE RESULTS OF EXAMINATIONS OF FOOD PRODUCTS IN 1905.

	Not found adul- terated.	Adulterated or below standard.	Com- pounds.	Total number examined.
<i>Sampled by Station.</i>				
Milk .....	95	133	...	228
Lard .....	47	24	...	71
Olive oil and substitutes.....	40	9	13	62
Coffee and coffee substitutes...	23	18	3	44
Vanilla extract.....	25	47	15	87
Lemon extract.....	35	39	12	86
Spices .....	137	22	...	159
Prepared mustard .....	...	...	28	28
Cream tartar.....	17	1	...	18
Total.....	419	293	71	783
<i>Sampled by Health Officers, Consumers and Dealers.</i>				
Milk .....	182	36	...	218
Cream .....	22	1	...	23
"Evaporated cream".....	2	...	...	2
Condensed milk.....	...	1	...	1
Butter .....	3	1	...	4
Vinegar .....	...	1	...	1
Coffee .....	2	...	...	2
Coffee substitutes.....	...	1	...	1
Spices .....	4	1	...	5
Chocolate.....	...	2	...	2
Cocoa.....	1	...	...	1
Rock candy drips.....	1	...	...	1
Maple syrup .....	1	...	...	1
Jam .....	...	1	...	1
Horse radish.....	...	1	...	1
Corn oil .....	...	1	...	1
Whiskey.....	3	...	...	3
Olive oil.....	2	1	...	3
Vanilla extract.....	...	...	1	1
Total .....	223	48	1	272
<i>Sampled by Dairy Commis- sioner.</i>				
Cream.....	5	...	...	5
"Steriline".....	...	...	1	1
Butter .....	15	7	3	25
Vinegar .....	3	...	...	3
Molasses.....	185	15	...	200
Milk .....	5	12	...	17
Spices .....	2	6	2	10
Lard .....	4	6	12	22
Cream tartar.....	...	...	1	1
Coffee .....	4	1	3	8
Total, .....	223	47	22	292
Total from all sources...	865	388	94	1347

W. D. BIGELOW.



**Tannin in Coffee.** BY C. D. HOWARD. *Sanitary Bull. New Hampshire State Board of Health*, Vol. 2, No. 10.—Five samples of coffee claimed by manufacturers to be free from tannin, and for that reason of such a nature that they can be used by those whose health does not permit them to drink coffee, were submitted to analysis. The percentage of caffetannic acid found varied from 6 to 11 per cent. In two of the cases the manufacturers based their claim for the complete removal of tannic acid upon the elimination during the process of grinding, of the chaff or skin occurring on the surface and, to some extent, enmeshed in the groove of the coffee bean. The writer shows that the removal of this membrane would not effect the separation of caffetannic acid, which is distributed through the bean.

W. D. BIGELOW.

**Analysis of Food Products.** BY E. H. S. BAILEY. *Bull. Kansas State Board of Health*, Vol. 2, No. 3.—The report gives the analysis of 31 samples of baking-powders, 8 samples of milk and 4 miscellaneous samples.

W. D. BIGELOW.

**Commercial Extract of Lemon.** BY A. MCGILL. *Lab. Inland Rev. Dept. Ottawa, Canada, Bull.* 114.—The report discusses the manufacture of lemon extract as well as a proper standard of composition, and gives the results of the analyses of 110 samples of lemon extract. Attention is called to the fact that although a high percentage of alcohol is essential for the solution of the proper amount of oil of lemon, 63 per cent. of the samples examined contain alcohol of less than 50 per cent. strength. It is quite certain that such samples contain only traces of lemon oil. The detailed analytical results are given in tabular form.

W. D. BIGELOW.

**Patent Medicines and Headache Powders.** BY A. MCGILL. *Lab. Inland Rev. Dept. Ottawa, Canada, Bull.* 113.—The bulletin contains the detailed results of the examination of 30 samples of headache powders and similar preparations, and 15 patent medicines. In patent medicines the percentages of alcohol and potassium iodide were determined. The headache powders were examined for the active drug.

W. D. BIGELOW.

**Notes on the Use of Acetic Acid and of Oxalic Acid for Extracting the Charred Material in Preparing Ash.** BY B. L. HARTWELL AND J. W. KELLOGG. *18th Annual Report, R. I. Agr. Expt. Sta.*—As a large amount of the alkalis in charred materials is insoluble in water, it is usual to treat the char with acetic acid in order to remove this water-insoluble alkali. Much silica, however, goes into solution in the acetic acid. The authors propose to use oxalic acid therefore to dissolve out the alkalis, and find it to work very well. The results on alkalis were as

high where the char was extracted with water as where it was extracted with oxalic acid.

F. P. VEITCH.

**Preliminary Experiments with a Cyanamide Compound as a Nitrogenous Fertilizer.** BY F. T. SHUTT AND H. W. CLARLTON. *Transactions Royal Society, Canada, II, Section 3, 73* (1905).—Experiments were made to determine the effect, on the germination and growth of wheat and peas, of calcium cyanamido-carboxylate and of potassium cyanamidocarboxylate. With the former salt neither germination nor growth was retarded when amounts equivalent to 5 mg. of nitrogen per 100 grams of soil were applied. When from 10 to 20 mg. of nitrogen per 100 grams of soil were present, toxic effects were marked and larger amounts were fatal to the plants, the potassium salt being more toxic than the calcium salt. Experiments conducted to show the rate of nitrification of cyanamide compounds in the soil indicated that where the quantity present was very small, nitrification was rapid but when quantities containing as much as 5.78 mg. of nitrogen per 100 grams of soil were present, nitrification was much delayed. This is doubtless due to the toxic effect on the nitrifying bacteria.

F. P. VEITCH.

**Recent Experiments in the Nitrogen Enrichment of Soils.**

BY F. T. SHUTT AND A. L. CHARRON. *Transactions Royal Society, Canada, II, Section 3, 53* (1905).—The rapidity with which the nitrogen of virgin soils is decreased is shown by analysis of the soils, and how this loss may be prevented through the growing and plowing down of leguminous crops is shown both from analyses of the soils and from the increase in yields of crop.

F. P. VEITCH.

**The Formation of Nitrates in the Soil.**

BY W. A. WITHERS *Bull. 109, North Carolina Agr. Expt. Sta.*—This bulletin contains a brief general discussion of the factors influencing nitrification and gives briefly the results of experiments showing the rate of nitrification of different nitrogenous materials in different soils.

F. P. VEITCH.

**Some Banana Soils of St. Mary and Upper St. Catherine.**

BY H. H. COUSINS. *Bull. Dept. Agr. Jamaica, W. I.*—Gives carbonate of calcium, humus and character of soil of a number of samples, and from these data and an inspection of the soil, attempts to advise as to treatment. Previous work indicates that these soils do not need fertilizers.

F. P. VEITCH.

**Analysis of Commercial Fertilizers Sold in Maryland.**

BY H. B. McDONNELL, *et al.*, *Maryland Agr. College Quarterly, No. 31.*—Analyses of a number of samples selected during the fall of 1905 are given.

F. P. VEITCH.

**Fertilizer Inspection.** BY J. M. BARTLETT. *Bull. 127, Maine Agr. Expt. Sta.*—This bulletin contains the analyses of manufacturers' samples of brands of fertilizers licensed before July 1, 1906. F. P. VEITCH.

**Commercial Fertilizers.** BY GEORGE ROBERTS. *Bull. 173, California Agr. Expt. Sta.*—This report gives the results of fertilizer inspections for the period from July to December 31, 1905, together with a list of the registered brands for the year beginning July 1, 1905. F. P. VEITCH.

**Commercial Fertilizers.** BY J. L. HILLS AND C. H. JONES. *Bull. 121, Vermont Agr. Expt. Sta.*—This bulletin gives the analytical data on 56 brands of fertilizer, samples of which were taken this year, together with the data secured during the past five years on the same brands. F. P. VEITCH.

**Report of Analyses of Samples of Fertilizers Collected by the Commissioner of Agriculture during 1905.** *Bull. 272, New York Agr. Expt. Sta.* F. P. VEITCH.

**Some Experiments with Insecticides for the San Jose Scale.** BY C. O. HOUGHTON. *Del. Expt. Sta. Bull. 74.*—Results are reported of some experiments with the use of the lime-sulphur-salt washes, and a number of commercial preparations known as "soluble oils." In the author's opinion the lime-sulphur-salt wash may show a wide range in composition and still be effective. A number of the "soluble oils" gave satisfactory results when applied in the spring, but none of these was effective for fall spraying. L. S. MUNSON.

**Spraying Experiments for San Jose Scale.** BY T. B. SYMONS AND A. B. GAHAN. *Md. Agr. Expt. Sta. Bull. 107.*—The bulletin gives results of tests of the lime-sulphur-salt washes and of a number of commercial preparations. In all cases the lime and sulphur washes showed superior results, and that wash is recommended by the authors as the most effective in destroying the scale. L. S. MUNSON.

**Waters of North Dakota.** BY E. F. LADD. *N. Dak. Agr. Expt. Sta. Bull. 66.*—The requisites of a good drinking-water are discussed and analyses are given of 160 artesian, well, spring, and river waters from various sections of the state. Of the 160 samples the lowest content of total solids was 42 parts per million and the highest content 26,860 parts per million; 112 samples contained more than 1000 parts per million, and 23 samples contained more than 5000 parts per million. L. S. MUNSON.

**Disposal of Household Wastes at Summer Resorts, Encampments and Farm Houses.** BY ROBERT FLETCHER. *Supplement*



*N. H. Sanitary Bull.* July, 1905.—The author discusses the various methods and appliances available for the disposal of household wastes, the necessity for the protection of drinking-water supply, ways of contamination, and construction of wells. He concludes that the principles to be kept in mind are the disposal of sewage in the superficial layers of the soil in not too great quantity, the disinfection of the stools of the sick with lime, the digging of wells in places permanently in grass and at some distance from barnyards, and above all their thorough protection from contamination from the surface and from the soil immediately below the surface.

L. S. MUNSON.

**The Estimation of Caseine.** BY H. V. ARNY AND T. M. PRATT. *Am. J. Pharm.* 1906, 121.—In order to obtain a quick method for the estimation of casein, the authors tried the use of alum and found that it combined with casein in molecular proportions. Owing to the fact that it is most difficult to determine the end-point of precipitation, or of the excess of alum in the whey, the use of ferric alum, which behaves exactly like alum, was tried and found to be successful. The process finally decided upon is as follows: "20 cc. of N/10 ferric alum solution (48.1 grams to the liter) is mixed with the desired amount of milk (5, 10, 20 or 30 cc.) at ordinary temperature, some water added, the mixture shaken and allowed to stand a few minutes, and then filtered, the precipitate being washed until the washings are free from iron. Either the whole filtrate or half of it is titrated with potassium iodide, acid and thiosulphate, and thus the amount of unused ferric alum is ascertained. The difference in the amount of ferric alum in the original solution and the amount in the whey gives the quantity of ferric alum required for the precipitation of caseine." The number of cubic centimeters of ferric alum used is always proportional to the number of cubic centimeters of milk taken. The other constituents of milk, *e. g.*, milk-sugar and fat do not enter the reaction with ferric alum. The number of cubic centimeters of ferric alum is then compared to the amount of nitrogen in the casein as determined by Kjeldahl's process, in order to establish a definite standard. The authors have not yet established this standard, but have published their method in the hope that others might be led to investigate it. The filtration is best done through cotton.

L. S. MUNSON.

### **Maintaining the Fertility of Rice Soils; A Chemical Study.**

BY G. S. FRAPS. *Bull. 82, Texas Agr. Expt. Sta.*—Analyses show the plant food content of the first twelve inches of a number of Texas rice soils as determined by the ten-hour digestion in 1.115 sp. gr. hydrochloric acid, the amounts of the same removed in the rice crop, and the amounts added by irrigation waters. The fact is brought out that, when the straw is removed from the

land, the phosphoric acid content of the soil and irrigation waters is sufficient for only 40 to 75 crops of 1900 pounds each of rough rice, the nitrogen content 40 to 120 crops, and the potassium content 90 to 600 crops. Phosphoric acid and nitrogen are particularly low in most cases, but there is a fair supply of potash and lime. The author recommends the growing of legumes to keep up the nitrogen and the trial of 100 pounds of acid phosphate per acre as a source of phosphoric acid. He includes some results from trials made on rice fields in Japan, which show beneficial effects from such sources of phosphoric acid as precipitated phosphate and Thomas slag phosphate.

J. H. PETTIT.

### PATENTS.

OCTOBER 3, 1905.

800,635. Carleton Ellis, Boston, Mass. Treating **lime**. A stream of water and a stream of lime in proper proportions to form a dry hydroxide are mechanically agitated during progress till a dry hydroxide is formed.

800,661. Esta A. Makepeace, Eldorado, Kansas. **Preserving eggs**. Magnesia, borax and potassium tartrate one part each, sodium chloride two, calcium oxide 4 parts and water 24.

800,683. Manuel V. Romerogarcia, New York, N. Y. **Food**. Kola and cocoa 200 each, banana flour or starch 400, sugar-cane 150, sarrapia or Guinea bean 10 and papaya 40, and enough water to make it plastic.

800,698. Utley Wedge, Ardmore, Pa. **Briquetting iron oxide** for furnace use. Fine particles of iron are moistened with sulphuric acid, the mixture heated to form ferrous sulphate, then stirred and heated till all sulphur is driven off.

800,735. Hugo Geldermann, Berlin, Germany. **Diaminodiphenylaminesulphonic acid**. *p*-Nitrochlorobenzene-*o*-sulphonic acid is coupled with aromatic metadiamines of the benzene series by treating the nitro compounds with reducing agents in weak acid solution. The acid has the following constitution,  $\text{NH}_2\text{C}_6\text{H}_3\text{SO}_3\text{H.NH.C}_6\text{H}_3\text{NH}_2$ . The acids are difficultly soluble in water, easily soluble in soda-lye and dilute hydrochloric acid, the soda solution turning blue by aeration, ferric chloride or potassium bichromate.

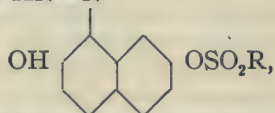
800,785. Heinrich Becker, Wiesdorf, Germany. **Soap**. A soft soap that can be used in cakes is made by adding to 1000 parts soft soap 450 of sawdust and 650 of sand together with 40 parts of soap solution.

800,807. Hans P. Larsen, Portland, Oregon. **Soldering flux**. Lard oil 6, rosin 2 and ammonium chloride 1 part by weight.

800,905. George P. Craighill and George A. Kerr, Lynchburg, Va. Assigned to N. C. Manson, Jr., same place. **Terpenes and resins.** Wood is first saturated with alkali to fix the volatile acids and oils and liberate the terpenes, which are separated by steam, while the rosin is recovered by water free from tar and oil.

800,913. Wilhelm Herzberg and Eduard Thon, Berlin, Germany. Assignors to Aktien Gesellschaft für Anilin Fabrikation, same place. **Nitrating aromatic amines.** Arylsulphamides of aromatic amines are heated with nitric acid of 1.03 density to 100°.

800,914. Wilhelm Herzberg, Berlin, Germany. Assignor to Aktien Gesellschaft für Anilin Fabrikation, same place. **Yellow-red azo dye.** The formula is  $\text{XN}=\text{N}$



being crystalline powders, difficultly soluble in water, dyeing wool from acid bath yellow-red to blue-red shades, forming brilliant lakes of the same color insoluble in water and oil, and on reduction with tin and hydrochloric acid yielding *o*-aminosulphonic acid and 2,7-dihydroxy-1-aminonaphthalene beside *p*-toluenesulphonic acid.

800,925. Willy Leobell, Klein Zschachwitz, near Dresden, Germany. Purifying **viscin**. Crude viscin (bird lime) is kneaded with calcium carbonate and burnt gypsum, extracting out the viscin by benzine and distilling off the benzine.

800,956. Maximilian Toch, New York, N. Y. **Coating exposed structures.** Sheets are coated on one side with a colodion, to which shellac, etc., has been added, and on the other with oxidized linseed oil and China wood oil, with or without pigments, and the sheets applied to the structure.

800,984. Henry M. Chance, Philadelphia, Pa. Purifying **metals**. The metal is fused in contact with a fused electrolyte containing a reagent that unites with the impurities and is electrolytically disengaged, as calcium chloride for iron and copper.

801,028. Willy Leobell, Klein Zschachwitz near Dresden, Germany. **Plasters.** Vaseline is added to viscin and the mixture stirred and heated.

801,066. Archie P. Eves, Akron, Ohio. **Devulcanizing rubber.** The material is heated with sodium sulphate and then mixed with barium chloride.

801,111. August E. Schutte, Belmont, Mass. Assignor to Warren Brothers Co., Boston, Mass. **Bituminous composition.** Finely pulverized clay is mixed with semi-liquid bitumen and broken stone incorporated with it.



801,129. Henry Arden, San Francisco, Cal. Assignor to John Treadwell, Oakland, Cal. **Reducing ores.** The pulverized ores are mixed with a hydrocarbon, water-glass and carbonaceous material, then briquetted and coked.

801,140. Jacob Englehardt, New York, N. Y. Assignor two-thirds to Lothar E. Schweitzer and Harry Neuber, same place. **Printing plates.** A sensitive coat is rolled on the grained surface of a plate, but not so as to fill the interstices or depressed portions, the surface is printed through a negative, the soluble parts washed out and the plate etched.

801,143-4. Heinrich E. Esch, Giessen, Germany. Assignor to Fellner and Ziegler, Frankfort-on-Main. Preparing **dust ores** for blast-furnaces. The ore is fed through a zone of increasing heat, then meets a stream of ignited fuel mixed with easily fusible material, agglomerating the mixture. The second patent is for roasting the materials and cleaning the clinker from the walls of the furnace by a cooling blast of air down the walls.

801,158. Rudolf Reis, Charlottenburg, and Otto Schmatolla, Berlin, Germany. Insoluble **aluminum acetate.** A concentrated solution of aluminum acetate is mixed with one-third its volume of concentrated acetic acid, boiled with stirring, and the precipitate washed and dried.

OCTOBER 10, 1905.

801,199. Edgar A. Ashcroft, Weston *via* Runcorn, England. **Alkali metals by electrolysis.** Fused sodium chloride is electrolyzed over a cathode of melted lead, the sodium lead alloy being made an anode, then a sodium hydroxide electrolyte is used and the sodium dissolved off from the anode and deposited at the cathode without consuming the secondary electrolyte.

801,274. Edward M. Schultz, Sergeants Hall, and George W. Helmlinger, Pittsburg, Pa. **Converting steel scrap into iron.** Steel scrap is fagotted with scale or cinder, heated to a welding heat, and pressed into shape.

801,296. Friedrich Bolling, Frankfort-on-Main, Bockenheim, Germany. Assignor one-half to Chemisch-Electrische Fabrik, same place. Molten blocks of **silicon carbide.** A body is made of pure carbon, fine silicon carbide powder is embedded in it and the whole fired at a high temperature.

801,317. Joseph P. R. James, Muscatine, Iowa. Making **shell powder.** The shells are packed in a solution of chloride of lime and bran, heated and put in a hot mixture of ammonia and skim milk and when the shells are soft they are dried at a high temperature in a dry kiln to a fine powder.

801,339. Gustav Reininger, Berlin, Germany. Assignor to Firma Cyanid Gesellschaft, same place. **Case hardening com-**

**pound.** Made of cyanamide of calcium 80, sodium carbonate 12, and animal refuse 24 parts.

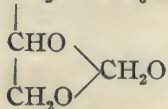
801,418. Paul Tomaschewski, Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. **Anthraquinone dye.** 1-Hydroxy-3-bromo-4-aminoanthraquinone, 10, is boiled five hours with cupric chloride  $\frac{1}{4}$ , naphthalene 100, sodium acetate 12, forming blue needles of cuprous luster soluble in hot quinoline blue-green, and in hot sulphuric acid olive-green; on reduction with caustic soda and hydrosulphite forms a "vat" solution.

801,430. Adolph Wurtze, Charlottenburg, Germany. **White lead color.** Carbonic acid is forced into neutral solutions of lead acetate under pressure.

801,470. Charles W. Merrill, Lead, S. D. Obtaining **precious metals.** Ore materials containing reducing agents as ferrous compounds are oxidized by air under pressure, having first separated most of the liquid, and then running on the cyanogen solution in the same container.

801,483. Karl Stephan and Paul Hunsalz, Berlin, Germany. Assignors to Chemische Fabrik auf Aktien, Berlin, Germany. **Camphor.** Borneol dissolved in benzene is oxidized by ozone.

801,484. Karl Stephan and Taddaus Emilewicz, Berlin, Germany. Assignors to Chemische Fabrik auf Aktien, same place. **Methyleneglycerol salicylic acid ester.** Salicylic acid reacts on a mixture of glycerol and formaldehyde, making an oily liquid of specific gravity 1.544 at 15° C., easily soluble in ether, alcohol, benzene, chloroform and castor oil, difficultly soluble in olive and sesame oils, insoluble in water, petroleum ether, vaseline and glycerol, its constituents being regenerated by dilute acids, and having the formula  $\text{CH}_2\text{OOC.C}_6\text{H}_4\text{OH}$ .



801,485. Karl Stephan and Paul Rehlander, Berlin, Germany. Assignors to Chemische Fabrik auf Aktien, same place. **Camphor.** The vapors of borneol are heated in oxygen and the camphor separated. Catalytic agents may be used to promote combination.

801,547. William Polatsik, Chicago, Ill. Assigned one-half to Simon Florsheim, same place. Treating **animal sinews.** The external coat is removed by soaking in petroleum products, then in a solution of boric acid or alum and copper sulphate two to one part; they are then immersed in alkali and finally in a tanning bath, and their constituent fibers separated.

801,597. Louis Lane, Toledo, Ohio. **Concrete mixture.** Ten per cent. of manganese dioxide and 90 per cent. of Portland cement, cellular slag and infusorial earth.

801,598. August L. Laska, Offenbach-on-Main, Germany. Assignor to K. Oehl Anilin und Anilin Farben Fabrik, same place. **Brown sulphur dye.** Formaldehyde and resorcinol are melted with the metadiamines of the benzene series and polysulphides. Blackish powders, soluble in concentrated sulphuric acid and in water brown, precipitated by hydrochloric acid in dark brown flocks.

801,656. Richard Eichhoff, Essen-Rittenscheid, Germany. Assignor to Electro Stahl Ges. mit Beschr. Haft., Remscheid-Hasten, Germany. **Deoxidizing ingot iron, steel,** etc. The metal is smelted and purified in a Bessemer or similar furnace, then transferred to another vessel, and a neutral slag formed on it, cooled, a reducing agent added to reduce the oxidation products, then heating up the metal to a casting temperature.

801,681. Charles Nurnberg, New York, N. Y. Assignor to Solomon Charles Hirschberg, same place. **Clinical thermometer.** The thermometer is enclosed in a transparent coating as celluloid, open at one end only, and provided with a cap on the other end, adapted to close the tube and hold the thermometer.

801,691. Alexander S. Ramage, Detroit, Mich. **Lactalbumen and milk sugar.** Whey is heated to dryness in films, dissolved in a little water, the proteids precipitated by alcohol and separated, then adding more alcohol to precipitate the lactose.

801,768. Milton Cole, Philadelphia, Pa. **Hone.** A hone with an aluminum surface for sharpening tools.

801,773. George Daseking, Hanover, Germany. Assignor to Joseph Berliner, same place. **Refining milk.** Milk is heated to 85° for twenty minutes, then centrifugated for separation and cooled to about 3°.

801,782. Alexander M. Gow, Allegheny, Pa. Assignor to George Westinghouse, Pittsburg, Pa. **Nitrogen compounds.** Hydrocyanic acid is made by the electric arc acting on a mixture of methane, oxygen and nitrogen.

801,820. Carl A. L. W. Witter, Hamburg, Germany. Assignor to Straits Trading Co., Straits, Singapore. **Tin from tin-lead alloys.** The alloy is oxidized by smelting and a blast of air, then reduced with carbon, to get an alloy rich in tin.

OCTOBER 17, 1905.

801,842. Nicholas A. Bibikov, New York, N. Y. Assignor one-fourth to Henry Connett, same place. **Paint for iron.** Zinc and fluorspar in fine powder are mixed with asphalt dissolved in petroleum and turpentine.



801,873. Jules H. Hirt, Brookline, Mass. **Plaster compound.** A carbonate and quicklime in fine powder are placed in a closed vessel and water in slight excess of the amount required to slake the lime added and thoroughly mixed.

801,874. As above, but exhausts the air while the lime is slaking.

801,879. John N. Judson, South Strafford, Vt. Separating **pyrrhotite**. Pyrrhotite, associated with chalcopyrite and gangue, is heated to make it so magnetic as to enable it to be separated by magnetic attraction.

801,951. Edward Wilde, New York, N. Y. Assignor to American Stone Paving and Construction Co., S. Dakota. Composition for **pavements**. Resin and ferric oxide are heated together, an earthy base incorporated, and the whole compressed.

802,012. Ambrose Monell, New York, N. Y. Separating **nickel and copper sulphides**. A solvent for sulphides like sodium sulphide is added to the matte containing sulphides in an open-hearth furnace where the mixture is heated to the melting-point of the solvent, poled till all the soluble sulphides are dissolved, the undissolved being allowed to settle and are separated.

802,049. Ivan Levinstein and Ernest E. Naef. Manchester, England. **Green-blue sulphur dye**. *p*-Nitrosophenol, is condensed with Cleves acids, the result reduced and the product heated with polysulphides. They are insoluble in water, soluble in concentrated sulphuric acid green-blue, insoluble in caustic alkali and sodium carbonate, alcohol, aniline and benzine, soluble in sodium sulphide gray-blue and forming a leuco compound dyeing greenish blue.

802,099. Eustace H. Gane, New York, N. Y. Assignor to McKesson and Robbins, same place. **Dentifrice**. Ammonium percarbonate 1, powdered chalk 96, and soap 3 parts.

802,100. George W. Gray, Whiting, Ind. Assignor to Standard Oil Co., Chicago, Ill. **Paraffin candles**. Hydroxystearic acid is dissolved in stearic acid three parts to one, and mixed with paraffin wax.

802,148. Robert R. Maffett, Bayonne, N. J. Assignor to International Nickel Co., New York. Refining **nickel copper matte**. Tops containing sulphides of copper, iron and of an alkali metal are treated by oxidizing the latter sulphide to a sulphate, melting in an oxidizing atmosphere, and separating the sulphate by gravity and heating and refining the copper.

802,153. Henry S. Blackmore, Mt. Vernon, N. Y. **Reducing metals**. A fused aluminum compound is traversed by a metal-yielding current between contacts, and an alternating current passed at an angle to the metal-yielding current.

802,169. Julius Lewy, Königsberg, Prussia, Germany. **Artificial wax.** Paraffin 100, ceresin 3, and a naphthol 2 parts.

802,188. Robert A. Hadfield, Sheffield, England. **Treating steel armor plate.** The plate is uniformly heated to from 950° to 1100° then slowly cooled, reheated to a lower temperature, say 700° to 720°, cooling slowly to 655° to 640°, then suddenly cooling, reheating to about 620° and suddenly cooling.

802,205. Arthur E. Gibbs, Niagara Falls, N. Y. **Making chlorates and bichromates.** A solution containing a chromate and a chloride is electrolyzed in a diaphragm cell, producing thereby a bichromate and a chlorate, withdrawing the solution from the cell, and separating the chloride from the bichromate, and returning the chloride to the cell with additions of normal chromate.

802,256. Max Bamberger and Friedrich Bock, Vienna, Austria-Hungary. **Heating composition.** Iron 4, and an alkali permanganate 3, and plaster of Paris 2 parts, the plaster slows down the reaction.

802,297. Karl Kuppers, Berlin, Germany. **High temperature flames.** A non-luminous flame not containing air is led into a Bunsen flame, the two combining to one flame.

802,311. William D. Patten, New York, N. Y. **Fire proofing compound.** Sodium dihydroorthophosphate, and ammonium sulphate. Melts below the point at which wood inflames.

802,354. Carleton Ellis, New York, N. Y. **Slaking lime.** etc. The lime is moved through a body of water so that it receives only about three-fourths to four-fifths the amount of water necessary for complete hydration, continuing its forward movement and stirring it, making a short slaked lime three-fourths hydrated.

OCTOBER 24, 1905.

802,377. Frederick M. Ekert, Ashland, Ohio. **Matter for packing lining and insulation.** Rubber, sulphur, fibrous asbestos, lead monoxide, resin, and high-resisting pore-filling substances as zinc, iron oxide, magnesium silicate and graphite are united together by vulcanization. Equal parts may be used but the proportions are varied to suit required conditions.

802,417-32 inclusive. All to John S. Stone, Cambridge, Mass. Assignor to Wm. W. Swan, trustee, Boston, Mass. **Space telegraphy.** In a system of space telegraphy, a sonorous circuit adapted to develop electrical oscillations of definite frequency, a resonant circuit attuned to said frequency, and conductively connected to the terminals of a coil included in said sonorous circuit, a coil included in said resonant circuit of inductance great as compared with the inductance of the first-mentioned coil,

and an elevated conductor system associated with said resonant circuit. See also 803,199.

802,471. John H. Powrie, Chicago, Ill. **Helichromic plate.** Different portions of a sensitized plate are successively exposed to the action of light. After each exposure the part exposed is developed and dyed, and the surface resensitized until the plate is complete.

802,487. Karl Wimmer, Bremen, Germany. **Removal of nicotine from tobacco.** Tobacco is put into a suitable extractor and treated with a solvent; the extract obtained is led through a series of vessels containing a substance which will absorb and precipitate the nicotine. The liquid is then distilled and carried back to the extracting vessel and the process repeated until the tobacco is sufficiently free of nicotine. The tobacco then is impregnated with the extracting liquid and dried.

802,493. Thomas S. Blair, Jr., Woodmore, N. Y. Assignor one-half to B. C. Lauth, Pittsburg, Pa. **Reducing metallic oxides.** Metallic oxides mixed with gangue are kept in motion in contact with reducing gases at a suitable temperature; the supply of oxygen is insufficient to consume the reducing agents and the reducing temperature is changed to a non-reducing one by admitting more air, and raising the temperature sufficiently to fuse the gangue and burn out the metalloids but not high enough to fuse the metal.

802,516. Josef Knops, Aix-la-Chapelle, Germany. **Artificial fuel.** Peaty substances are boiled to remove their juice and are exposed to heat; leather offal is boiled, dried and reduced to a powder. The product obtained from the peaty material is mixed with the leather flour and the mixture made into briquets by heat and pressure.

802,608. Ernest Stoffler, Zurich, Switzerland. **Lime and sand bricks.** Sand and caustic lime are ground together and the particles of sand fractured. Steam is admitted during the grinding; the mass hardens, chemical action taking place between the lime and the particles of sand.

802,620. Christian Birkeland and Samuel Eyde, Christiana, Norway. **Treating ores.** An electric arc is formed in a narrow chamber and a magnetic field formed around it to spread the arc, the enclosing chamber is filled with gas, then powdered ore is dropped through the chamber and arc, and the gaseous and solid products withdrawn from the bottom of the chamber.

802,657. John D. Pennock, Syracuse, N. Y. Assignor to the Solvay Process Co. **Filling material.** The waste mud from the manufacture of caustic soda by the lime process is floated and washed to remove soluble sodium carbonate and impurities, and carbon dioxide is passed through the suspended product at a



suitable temperature. The carbonated product is removed from the water and dried.

802,670. Maximilian Toch, New York, N. Y. **Waterproof compound.** Hard bitumen dissolved in chinawood oil and linseed oil, to which gum kauri fused in linseed oil and petroleum bitumen are added and the whole thinned to 0.95 specific gravity by benzene, naphtha or turpentine.

802,680. William B. Chisolm, Charleston, S. C. **Preservation of wood.** Fused calcium sulphide is used to impregnate the pores and to give an exterior protective coating to wood.

802,711 Wm. F. A. Schrader, Brooklyn, N. Y. Assignor to Traun Rubber Co., College Point, N. Y. **Rubber sheeting.** Made of rubber, a solid homogeneous perfume and the sulphur of vulcanization.

802,739. Joseph A. Deghuee, New York, N. Y. Assignor two-thirds to Sarah F. Bevier, Nyack, N. Y. **Preserving and waterproofing wood.** Wood is first heated and while heated and under pressure is treated with a mixture of creosote-oil 60, resin 30, saponifiable oil 5, and sulphur 5 parts, and allowed to cool while immersed in the reagents.

802,792. Lorenz Ach, Mannheim, Germany. Assignor to C. F. Boehringer & Soehne, same place. **Making camphor.** Isoborneol is dissolved in benzene, to which is added a solution of chlorine in water. The mixture is stirred until the reaction is complete and allowed to stand until the water and the benzene with the camphor have separated.

802,793. **Same.** In the preparation of camphor nitrous vapors are passed into a solution of isoborneol, cooled and allowed to stand several hours; then agitated with water and an aqueous alkali solution and the solvent evaporated.

802,835. Arnold Voswinkel, Berlin, Germany. **Double salt of ferric chloride and cotarnine hydrochloride.** Ferric chloride and cotarnine hydrochloride in solution are made to react in the proportion of one molecule of the former and two molecules of the latter. The product is removed from the water and dried.

802,882. John F. Piver, Cordele, Ga. **Extraction of turpentine and rosin from wood.** Wood is placed in a chamber and heated to about the boiling-point of water; the bottom of the chamber is cooled, vapors of turpentine are injected at the top of the chamber and the heating continued.

802,900. John F. Wyher, Pittsburg, Pa. **Artificial stone.** Consists of a mixture of slag, cinder, iron scales, and tin in suitable proportions melted and molded.

802,914. Henry D. Christensen, Spencer, Iowa. **Making**

**tile.** Tile for roofing, etc., is made by mixing a solution of an alkaline silicate with a concrete composition and molded into the desired shape. The mold and its contents are jarred to bring the silicate to the top, and the mass is dried.

802,928. Peter Fireman, Alexandria, Va. Assignor one-half to Edward G. Portner, Washington, D. C. **Printing ink pigment.** A ferrous salt in solution is precipitated by an alkaline substance and the precipitate oxidized by a current of air to form black ferro-ferric oxide; it is washed and dried with exclusion of air. In the dried precipitated magnetic ferro-ferric oxide the proportion of the ferrous to the ferric iron is within the limits of about one to two or one to three, and when rubbed on white paper will leave a black impression without brown streaks, and when mixed with a suitable varnish will print a decided black.

OCTOBER 31, 1905.

802,980. Frederick A. Feldkamp, Newark, N. J. **Making oxalic acid.** A mechanical mixture of carbon monoxide and carbon dioxide are brought into combination with an alkaline hydroxide; this is heated to form a mixture of an alkaline formate and carbonate of soda, then heated to a greater degree until the generation of hydrogen ceases. Slaked lime is added and forms calcium oxalate and calcium carbonate, the alkaline hydroxide is reproduced; sulphuric acid is added to form oxalic acid and calcium sulphate.

803,190. Charles H. Parker and John Mandile, Boston, Mass. **Roofing compound.** Twenty-five gallons of coal tar are heated and to it is added three hundred pounds of ground slate; after thorough mixing one hundred pounds of calcined plaster of Paris are added and the whole well mixed.

803,285. Stephen J. Hyde, Kansas City, Mo. **Fire- and water-proofing composition.** Portland cement, powdered burnt clay and mineral wool one part each, coarse burnt clay three parts and water sufficient to make a mortar

803,391. Henry S. Blackmore, Mount Vernon, N. Y. **Libera-ting and separating fibers.** The binding material of fibers is rendered soluble by the action of chemical substances and separated from each other while moist by subjecting them to the alternate action of alkaline and acid substances, such as ammonia and carbon dioxide.

803,392. Same. **Separating and bleaching fibers.** The material to be treated is saturated with a substance capable of decomposing the binding substance, as an alkali aluminate, and exposed to the action of water and sulphur dioxide.

803,472. Alfred V. Cunningham, Winnington, England. **Ex-traction and purification of zinc.** Zinc ores are calcined and comminuted and treated with a solution of a zinc salt, as the

chloride, and the acid which forms the salt; the solution is kept neutral and the zinc is obtained in the usual manner. In ores that contain arsenic the solution is rendered neutral by an alkali and the arsenic separated by freshly precipitated ferric hydroxide.

803,479. Miklos Gerster, Budapest, Austria-Hungary. Assignor one-half to Heinrich Freund & Söhne, same place. **Artificial stone from magnesite.** Magnesite is burned only to the point where the carbon dioxide is given off and is then granulated and pressed into bricks which are burned.

803,506. James Reaney, Jr., Sherwood, Md. **Hydrating lime.** The lime is moistened and agitated so that the heavier unhydrated particles settle to the bottom and the lighter ones float upon the top, and pass off and over the screen; they are kept in an atmosphere of steam until thoroughly hydrated.

803,534. Charles K. Harding, Chicago, Ill. **Producing combustible gas mixtures.** Liquid hydrocarbons are brought in contact with a vaporizing surface in proximity to which is a catalytic agent which is first heated, the heat being confined to only a portion of the vaporizing surface; the vapors are mixed with air and passed in contact with the catalytic agent. Partial combustion takes place and the temperature of the catalytic agent is maintained.

WILLIAM H. SEAMAN



# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**A Stony Meteorite from Coon Butte, Arizona.** BY J. W. MALLET. *Am. J. Sci.* 21, 347-355; figures.—This is probably the larger portion of a meteorite seen to fall June 24, 1905, but a short distance from the locality rendered famous by the numerous meteorites that pass under the name Canyon Diablo. Its weight is 2789 grams, its sp. gr. 3.471. It is probably to be classed as Brezina's (Cgb), a breccia-like gray chondrite. Its mineral composition is: Enstatite, 44.73; olivine, 33.48; maskelynite (?), 6.87; nickel-iron, 8.63; iron rust, 3.03; schreibersite, 0.76; pyrrhotite, 2.14; chromite, 0.08; total, 99.72. The composition of the components, so far as determined, follows. *Nickel-iron*: Fe, 88.81; Ni, 10.72; Co, 0.15; Sn, 0.01; Cu, Mn, C, traces; total, 99.69. *Maskelynite*:  $\text{SiO}_2$ , 55.00 (assumed);  $\text{Al}_2\text{O}_3$ , 25.0 (assumed); CaO, 14.17;  $\text{Na}_2\text{O}$ , 5.93;  $\text{K}_2\text{O}$ , 1.72; total, 101.82. *Olivine*:  $\text{SiO}_2$ , 42.29;  $\text{TiO}_2$ , 0.006; MgO, 42.44; FeO, 13.57; total, 98.306. *Enstatite*:  $\text{SiO}_2$ , 53.87; MgO, 26.55; FeO, 18.35; total, 98.77. Petrographic notes by Dr. G. P. Merrill accompany the paper. W. F. HILLEBRAND.

**On a New Stony Meteorite from Modoc, Scott County, Kansas.** BY G. P. MERRILL, with analyses by WIRT TASSIN. *Am. J. Sci.* 21, 356-360.—The meteorite fell September 2, 1905, and up to the present 14 pieces, mostly complete individuals, have been reported found. Of these, three and a fragment have been received at the U. S. National Museum, the largest weighing 4640 grams, the fragment 110 grams. No sections have been made. The stone is a gray chondrite, Brezina's (Cwa), and will be known as the Modoc, Scott County, meteorite. The specific gravity, determined on two complete individuals, is 3.54. Fractional analyses were made with the following results: *Nickel-iron*: Fe, 6.56; Ni, 0.68; Co, 0.034. *Soluble silicates*:  $\text{SiO}_2$ , 17.38; FeO, 10.95;  $\text{Al}_2\text{O}_3$ , 0.20; CaO, 0.14; MgO, 17.73. *Insoluble silicates*:  $\text{SiO}_2$ , 26.75; FeO, 4.42; MnO, 0.10(?);  $\text{Al}_2\text{O}_3$ ,

2.27; CaO, 1.60; MgO, 8.72; K<sub>2</sub>O, present but not determinable; Na<sub>2</sub>O, 0.44. In addition: S, 1.38; P, 0.051; total, 99.40. From these data the calculated mineral composition is: Nickel-iron, 4.59; troilite, 3.79; schreibersite, 0.34; olivine, 46.40; enstatite, 29.94; other insoluble silicates, 14.36; total, 99.42. The identity of the "other insoluble silicates" could not be determined. At the close, mention is made of a pebble-like mass of 135 grams weight sent with the preceding, which, while of meteoric origin, seems to be different from them. It is perhaps a straggler from the Jerome fall of 1894 from the adjoining County of Gove, described by Washington in the *American Journal of Science* for June, 1898.

W. F. HILLEBRAND.

**The Determination of the Feldspars by Means of their Refractive Indices.** BY FRED. EUGENE WRIGHT. *Am. J. Sci.* 21, 361-363.—By applying the principles developed by Schroeder van der Kolk the author has been able to work out a practical method, for which reference must be made to the original.

W. F. HILLEBRAND.

**Description of the Ebensburg (Pennsylvania) Quadrangle.** BY CHAS. BURTS.—This is the descriptive text accompanying *Folio No. 133 of the Geol. Atlas of the U. S.*, issued by the Geol. Survey. In the section on economic geology are 17 proximate analyses of coals, mostly made in the survey laboratory. The analysts should not be held responsible for the inclusion of sulphur and phosphorus in the summations of these analyses.

W. F. HILLEBRAND.

**Geology and Mineral Resources of Part of the Cumberland Gap Coal Field, Kentucky.** BY G. H. ASHLEY AND L. C. GLENN, in coöperation with the *State Geological Department of Kentucky*, C. J. Norwood, Curator. *U. S. Geol. Survey, Professional Paper No. 49*, 239 pp.; maps, plates.—Analyses are numerous, all proximate and gathered from several sources.

W. F. HILLEBRAND.

**Idaho and Thunder Mountain.** BY A. E. BORTHWICK. *Froc. Amer. Mining Congress, 1904, Part II*, 38-45.—An account of mineral resources. **Geology and Mineral Resources of Wyoming.** BY HENRY C. BEELER. *Ibid.* 113-118. **Mineral Resources and Mining in Oregon.** BY FRANK V. DRAKE. *Ibid.* 119-128. **Mineral Resources of South Carolina.** BY EARL SLOAN. *Ibid.* 129-160. **Mineral Resources of Vermont.** BY G. H. PERKINS. *Ibid.* 161-165. **Mining Industries of California.** BY THE STATE MINING BUREAU. *Ibid.* 177-199. **Geology and Mineral Resources of Idaho.** BY ROBERT N. BELL. *Ibid.* 200-226. **Mineral Resources of Maine.** BY LESLIE A. LEE. *Ibid.* 227-232.

E. C. SULLIVAN.

**Laboratory of Applied Electrochemistry at Columbia University.** BY SAMUEL A. TUCKER. *Electrochem. Met. Ind.* 4, 175-178.—A description in detail of this recently equipped laboratory.  
E. C. SULLIVAN.

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### ANALYTICAL CHEMISTRY.

**The Electrolytic Assay of Lead and Copper.** BY GEORGE A. GUESS. *Eng. Min. J.* 81, 328 (1906); also *Trans. Am. Inst. Min. Eng., Bi-monthly Bull.* No. 61, 1905.—Owing to an increasing demand for greater speed and higher accuracy in making daily analyses of ores and products from mills treating material containing but very small quantities of lead and copper, the older analytical methods have been forced out by new ones devised to meet the needs of modern work. Ordinary electrolytic methods are accurate and satisfactory but the expensive platinum electrodes needed make an installation of many units very costly. The author has devised a set of thin electrodes which are most satisfactory and which reduce the cost of platinum per cell enormously. These electrodes are cut from platinum foil 0.001 inch in thickness. The cathodes are 6.25 cm. long, 4 cm. wide with a tongue 0.7 cm. wide and 6.25 cm. long, the immersion area being 50 cm<sup>2</sup>. and the weight 1.5 grams with the blade sandblasted and corrugated lengthwise. The anodes are 12.5 cm. long by 0.5 cm. wide and have median corrugations. For lead analysis there are two cathodes and one anode hung between them in each cell. The ore is treated with nitric acid, any lead sulphate formed being dissolved by an ammonium nitrate solution containing free ammonia. This solution is made acid with nitric acid and electrolyzed by a current of from 1.5—2.0 amperes after which the anode is washed with water and alcohol, ignited and weighed. The theoretical factor is 0.866 but 0.855 is found to be more accurate on account of the excess of oxygen in the peroxide. Bismuth, arsenic and tellurium interfere and in order to make the deposit adhere, it is necessary to sandblast the anode before the determination. The same style of cell is used for copper work. In order to cut down the time usually necessary for a copper analysis, the author is using a nitro-hydrocarbon compound which is added to the solution undergoing electrolysis. This is made by treating No. 4 hard oil of the Standard Oil Co., with strong nitric acid, about 2 cc. of the solution in 100 cc. of the nitric acid solution of copper successfully preventing the deposition of arsenic or antimony, even if present in large amounts, and giving a smooth bright deposit of copper in about one-fourth the time ordinarily consumed. The current density used is 3 amp. dm<sup>2</sup>. The cathode must be sandblasted and no evolution of gas should take place until all the copper is precipitated.

R. C. SNOWDON.



**Variable Sensitiveness in the Colorimetry of Chromium.**

By D. W. HORN. *Am. Chem. J.* **35**, 253-258.—In ordinary colorimetric work it is assumed that the sensitiveness of the method is the same for all concentrations provided the solutions are reasonably dilute. The work here reported casts some doubt upon this assumption. Careful colorimetric comparisons of potassium chromate solutions of known concentration showed that the sensitiveness increased with dilution to a maximum after which it fell off rapidly. The maximum is found in concentrations between 0.004 nitrogen and 0.008 nitrogen with respect to the gram-atom of chromium. A few tests with solutions of green chromium chloride gave similar results.

E. E. FREE.

**The Titration of Molybdenite.** By J. OHLY. *Chem. Eng.*

**3**, 152.—The very finely divided ore is dissolved in nitric acid and the nitric acid removed by evaporation with concentrated sulphuric acid. This solution is diluted, and filtered, and chemically pure zinc is added to reduce the  $\text{MoO}_3$ . After about half an hour the solution assumes a chocolate color and the molybdenum is entirely reduced to the  $\text{Mo}_2\text{O}_3$  condition. The solution is now titrated with potassium permanganate that has been standardized against  $\text{MoO}_3$  dissolved in sulphuric acid and reduced by zinc. As iron is always present, it must be determined separately and allowed for in the calculation, or it must be removed by precipitation with ammonia before the determination of the molybdenum.

L. F. HAWLEY.

**Colorimetric Determination of Small Amounts of Gold.** By

R. N. MASON. *Am. J. Sci.* **21**, 270.—The red colloidal gold suspension, produced by the reduction of auric chloride by acetylene, was used for the colorimetric determination. This coloration is unstable in the presence of traces of electrolytes, and therefore pure water solutions were used and care was taken to exclude fumes and to have the containing vessels free from soluble material. Determinations were made of solutions containing from 0.0008 gram to 0.00004 gram of gold with a maximum error of 0.00006 gram.

L. F. HAWLEY.

**A Portable Apparatus for the Analysis of Flue Gases.** (Ab-

stract of a paper by the same author in *Proc. Inst. Civ. Eng.* **162**, 407-411 (1905). By CHARLES JOSEPH WILSON. *Eng. Min. J.* **81**, 279 (1906).—An apparatus consisting essentially of a water-jacketed gas burette with a capacity of 50 cc., but divided into 100 equal parts. The upper end of the burette is connected by a capillary tube with the upper end of a cylindrical pipette in which the absorptions take place. The capillary tube is provided with a three-way glass stop-cock through the side-arm of which (1) the gas sample may be drawn into the burette, (2) the respective absorbents for carbon dioxide, oxygen and carbon

monoxide may be introduced into the pipette, and (3) water or dilute acid may be drawn into either burette or pipette for the purpose of rinsing out adhering portions of the reagents. Both burette and pipette are connected at the bottom by means of rubber tubing with level bulbs that may be adjusted to any desired height. Mercury is used as the confining liquid in both burette and pipette. Measurement of the gas volumes is greatly facilitated by a glass side-arm of small diameter that enters the burette near the bottom, and passes upward close to the burette throughout its entire length. The upper end of this side-arm is closed by a glass stop-cock that remains closed except at the moment of reading the volume of the gas. The apparatus was employed with satisfactory results in all the trials recently carried out by the (English) Admiralty Committee on Naval Boilers, and is now used in the English dockyards. A. W. BROWNE.

**Report on the Operations of the Coal-testing Plant of the U. S. Geological Survey at the Louisiana Purchase Exposition, St. Louis, Mo., 1904.** *Professional Paper No. 48, Part III, pages 981-1473.*—*Producer-gas, Coking, Briquetting and Washing Tests.*

*Producer-gas Tests.* BY ROBERT H. FERNALD. Pages 981-1325.—An elaborate statement of the methods employed and of the results obtained in 24 practical tests upon producer-gas from samples of bituminous coals and lignites procured from 14 different states and territories. In these tests a Taylor pressure gas producer known as a 250 horse-power producer-gas power plant, a three-cylinder vertical Westinghouse gas engine, a six-pole 175 kilowatt Westinghouse direct current generator and numerous accessories were employed. The present work, which is to some extent preliminary in character, was conducted in order to demonstrate the possibility of using these coals in a producer, rather than to determine the maximum efficiency with which they could be burned.

*Coking Tests.* BY FRED. W. STAMMLER. Pages 1326-1367.—A study of the coking qualities of 44 different coals from 11 states. Thirty-two tests were made on 29 different samples of raw coal, and 27 tests were made on 24 samples of washed coal. Two tests were made on briquettes of non-coking coal.

*Foundry Tests of Coke.* BY DR. RICHARD MOLDENKE. Pages 1367-1388.—A description of 19 practical melting tests made in a small model foundry upon those cokes which showed any likelihood of value to the foundry industry. All conditions were kept as constant as possible in order to permit comparison of results. A constant height of 14 inches above the lower tuyères was used (the upper tuyères being kept closed); the blast-pressure was held at about 7 ounces, and the melting ratio was fixed at 1 to 7. For purposes of comparison tests were also made with well-known foundry cokes.

*Briquetting.* BY JOSEPH HYDE PRATT. Pages 1389-1459.—

The briquetting plant consisted of two machines of distinctly different type. One was of English make, and consisted of a double compression vertical table press, with closed molds and accessories. The other was of American make, and consisted of a Chisholm, Boyd and White press with accessories. Each machine was operated by a 50 horse-power motor. The following binders were tried in the laboratory experiments and on the two machines: pitch of various grades, creosote, asphalt (hard and soft, crude and refined), asphaltic pitch, petroleum (both of paraffin and asphalt bases), molasses, lime and clay. Coals from many different localities were tested, with results which the author summarizes as follows: "From the experimental work that has been carried on at the briquetting plant, it has been fully demonstrated that (1) some of the American coals, as those from Arkansas, and the slack produced in mining these coals, can be briquetted on a commercial basis; (2) in a number of instances the briquetted coal makes a better fuel and will stand transportation better than the original coal; (3) it is possible to briquette anthracite culm with pitch without the addition of any bituminous coal, and the briquettes will stand up in the fire without crumbling, and burn like a lump of anthracite coal; (4) coke breeze can be briquetted, making a fuel that in burning is similar to an anthracite coal, and can bear transportation as well as the coal; (5) it is possible by the use of pitch to produce coke from a naturally non-coking coal."

*Washing Tests.* BY JOHN D. WICK. Pages 1460-1473.—The washery plant was provided with four 35-ton storage bins, and with two bins of half the size for holding material to be washed. The washing apparatus consisted of a New Century jig designed for washing very fine material, and a modified Stewart jig for washing pieces 1.5 inches in diameter. Complete washing tests were made upon three samples of coal, and a great many charges of coal for the coke ovens were washed, usually with fairly satisfactory results, as shown by comparison of the percentages of ash and sulphur in the washed and unwashed material.

A. W. BROWNE.

**Crushing Tests of Diamonds Used in Drilling.** BY ALEXANDER N. MITINSKY. *Eng. Min. J.* 80, 1120.—Several black diamonds were subjected to pressure between a hard and a soft steel surface and their breaking strength was found to vary from 56.7 to 77.5 kg. per square millimeter with an average of 68 kg. per square millimeter.

B. S. CUSHMAN.

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## ORGANIC CHEMISTRY.

**Camphoric Acid: Some Derivatives of Aminolauronic Acid** (Fifteenth Paper). BY WILLIAM A. NOYES AND RENÉ DE M.



TAVEAU. *Am. Ch. J.* **35**, 379-386.—When the nitroso derivative of the anhydride of aminolauroic acid is boiled with an aqueous 10 per cent. solution of sodium hydroxide, in the proportion of one molecule of the nitroso body to one and a half molecules of sodium hydroxide, there result the following products: A hydrocarbon,  $C_8H_{14}$  (27.8 per cent.); isocampholactone (21.4 per cent.); an unsaturated acid,  $C_8H_{13}COOH$  (6.6 per cent.); liquid acids, mainly  $\gamma$ -lauronic acid (?) (1.4 per cent.); impure hydroxylauronic acid (1.7 per cent.); and a new lactone,  $C_8H_{14}$   $\begin{array}{c} \diagup CO \\ | \\ O \end{array}$

(4 per cent.). EXPERIMENTAL.—*Isocampholactone* was purified by distilling under diminished pressure. It melts at  $32-33^\circ$ , and boils at  $123.4^\circ$  at 28 mm., or  $125.6^\circ$  at 30 mm. The *Methyl Ether of the Hydroxy Acid Corresponding to Isocampholactone*,  $C_8H_{14}(OCH_3)COOH$ , was formed when the silver salt of the hydroxy acid was treated with methyl iodide. It separated from solution in isocampholactone in large, compact, beautiful crystals. By precipitating its sodium salt with hydrochloric acid, it was obtained in needles. It melts at  $84^\circ$ , and boils at about  $150-153^\circ$  at 19 mm. *Barium Salt*,  $(C_8H_{14}(OCH_3)COO)_2Ba$ . Among the *Substances Volatile with Water Vapor, Other than Isocampholactone* and  $\gamma$ -lauronic acid, there were separated a small amount of an *Acid*, melting at  $90-90.5^\circ$ , and a *Crystalline Unsaturated Acid*,  $C_8H_{13}COOH$ .—The latter melts at  $152-154^\circ$ , and sublimes at  $130-133^\circ$  at 21 mm. Its solution in sodium carbonate instantly decolorizes a potassium permanganate solution. It is easily soluble in the ordinary organic solvents, and is probably identical with an acid (m. p.  $153^\circ$ ) obtained by Walker and Henderson from the mixture of esters produced on electrolyzing potassium alloethylcamphorate. *Silver Salt*,  $C_8H_{13}COOAg$ . *Calcium Salt*,  $(C_8H_{13}COO)_2Ca \cdot H_2O$ . In addition to a small amount of impure hydroxylauronic acid, there were found, among the *Substances not Volatile with Water Vapor*, a consider-

able amount of a *New Lactone*,  $C_8H_{14}$   $\begin{array}{c} \diagup CO \\ | \\ O \end{array}$ , which was obtained

in beautiful crystals, m. p.  $164-165^\circ$ , by crystallization from ether or by sublimation. This lactone is easily soluble in the usual organic solvents, does not reduce a neutral permanganate solution, is not soluble in strong potassium carbonate solution, and its solution in absolute alcohol shows a rotation of  $[\alpha]_D = +13.87^\circ$ . The *Hydroxy Acid Corresponding to the Lactone*,  $C_8H_{14}(OH)COOH$ , melts at  $189.5^\circ$  with decomposition, but without darkening. Its *Barium Salt*,  $(C_8H_{14}(OH)COO)_2Ba \cdot 4H_2O$ , crystallizes well. Silver nitrate gives no precipitate in a solution of the potassium salt of the acid.

M. T. BOGERT.

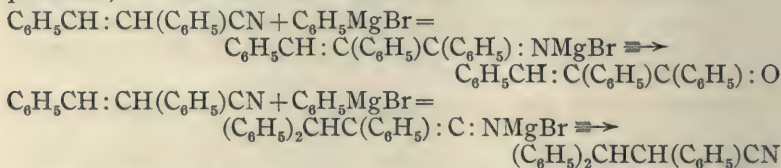
**On the Composition of Petroleum.** BY CHARLES F. MABERY.

**The Sulphur Compounds and Unsaturated Hydrocarbons in Canadian Petroleum.** BY CHARLES F. MABERY AND WILLIAM O. QUAYLE. *Am. Ch. J.* **35**, 404-432.—Previously published in *Proc. Am. Acad.* **41**, 89-113 (see this journal, **28**, R 94).

M. T. BOGERT.

**The Reaction between Unsaturated Compounds and Organic Magnesium Compounds. VIII. Reactions with  $\alpha$ - $\beta$ -Unsaturated Nitriles.** BY E. P. KOHLER. *Am. Chem. J.* **35**, 386-402.

—A study of the reactions of Grignard's reagent and cinnamonnitrile,  $\alpha$ -phenylcinnamonnitrile, and  $\beta$ -phenylcinnamonnitrile. With the first and last of these, only products similar to those obtained from saturated nitriles could be isolated. Cinnamonnitrile and phenylmagnesium bromide, for example, gave small yields of benzalacetophenone:  $C_6H_5CH:CHCN + C_6H_5MgBr = C_6H_5CH:CHCC_6H_5:NMgBr \Rightarrow C_6H_5CH:CHCOC_6H_5$ .  $\alpha$ -Phenylcinnamonnitrile and ethylmagnesium bromide gave a 98 per cent. yield of a product consisting of the stereoisomeric nitriles formed according to the equation  $C_6H_5CH:C(C_6H_5)CN + C_2H_5MgBr + H_2O = C_6H_5CH(C_2H_5)CH(C_6H_5)CN + MgBrOH$ . The magnesium derivative may have either of the two possible formulas (I)  $C_6H_5CH(C_2H_5)\dot{C}(C_6H_5)CNMgBr$  or (II)  $C_6H_5CH(C_2H_5)C(C_6H_5):C:NMgBr$  according to whether the reagent adds to the unsaturated carbon atoms or to the carbon and nitrogen in the 1,4-positions. It is shown that most of the reactions of the magnesium derivative may be interpreted by either formula, but formula II seems the best after taking all the available facts into consideration. Formula I represents a complex Grignard derivative that could not be made, however, from the corresponding bromine compound nor did it have the usual reactions of a Grignard reagent.  $\alpha$ -Phenylcinnamonnitrile and phenylmagnesium bromide gave two products, an unsaturated ketone and a saturated nitrile:



**EXPERIMENTAL PART.** (I)  $\alpha$ -Phenylcinnamonnitrile and Ethylmagnesium Bromide.—The nature of the final product was found to be independent of the conditions of the experiment. The primary product was always a red compound shown to be a double compound containing the nitrile in place of ether. This disappeared rapidly when heated, or more slowly in the cold, until an excess of the nitrile had been added, when it became permanent. The procedure used was as follows: Solid nitrile was added, in small portions, to a boiling solution of ethylmagnesium bromide until a faint but persistent color appeared in the liquid.

The resulting solution of the magnesium derivative was then treated with various reagents as described below: *α-β-Diphenylvaleronitrile*,  $\text{C}_6\text{H}_5\text{CH}(\text{C}_2\text{H}_5)\text{CH}(\text{C}_6\text{H}_5)\text{CN}$ .—The magnesium derivative was poured on cracked ice, giving a product consisting of a mixture of stereoisomeric nitriles; one, small lustrous crystals, melting-point  $115^\circ$ , boiling-point  $235\text{--}240^\circ$  (20 mm.), readily soluble in acetone and boiling alcohol, moderately soluble in cold alcohol and ether, the other, an oil boiling at  $210\text{--}212^\circ$  (20 mm.). Both were hydrolyzed to mixtures of isomeric acids. *α-β-Diphenylvaleric Acids*,  $\text{C}_2\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{CH}(\text{C}_6\text{H}_5)\text{COOH}$ .—The higher melting acid separates from ligroin in small lustrous plates, melting-point,  $178^\circ$ , moderately soluble in ether and very sparingly so in ligroin. The lower melting acid separates more slowly from ligroin, in clusters, melting-point  $152\text{--}153^\circ$ , readily soluble in alcohol and ether. Each acid gave a mixture of the two acids when heated to  $180^\circ$  with concentrated hydrochloric acid. *Ethyl-diphenylvaleronitrile*,  $\text{C}_6\text{H}_5(\text{C}_2\text{H}_5)\text{CHC}(\text{C}_6\text{H}_5)(\text{C}_2\text{H}_5)\text{CN}$ , by action of ethyl iodide on the magnesium derivative, crystallizes in large tabular plates, melting-point  $105^\circ$ , readily soluble in acetone, alcohol, ether, and chloroform, moderately so in ligroin. All attempts to hydrolyze this nitrile, or to obtain a ketone from it by the Grignard reaction, failed. Its structure was finally shown by obtaining 3,4-diphenylhexane from it by reduction with sodium and boiling amyl alcohol. *Methyldiphenylvaleronitrile*,  $\text{C}_6\text{H}_5(\text{C}_2\text{H}_5)\text{CHC}(\text{CH}_3)\text{C}_6\text{H}_5\text{CN}$ , crystallizes in prisms, melts at  $99^\circ$  and is readily soluble in alcohol and ether. It would not hydrolyze. *Benzoyldiphenylvaleronitrile*,  $\text{C}_6\text{H}_5(\text{C}_2\text{H}_5)\text{CHC}(\text{CH}_2\text{C}_6\text{H}_5)\text{C}_6\text{H}_5\text{CN}$ .—Needles containing one molecule of benzene. It is readily soluble in benzene, acetone, and boiling alcohol, sparingly so in cold alcohol or ligroin. Melting-point  $140^\circ$ . *Benzoyldiphenylvaleronitrile*,  $\text{C}_2\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{C}(\text{COC}_6\text{H}_5)(\text{C}_6\text{H}_5)\text{CN}$  or  $\text{C}_2\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{C}(\text{C}_6\text{H}_5): \text{C} : \text{NCOC}_6\text{H}_5$ .—It crystallizes from alcohol in large needles melting at  $137^\circ$ . Readily soluble in chloroform, acetone and boiling alcohol, moderately so in cold alcohol and ether, almost insoluble in ligroin. The acid,  $\text{C}_2\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{C}(\text{C}_6\text{H}_5)\text{CNCOOH}$  or  $\text{C}_2\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{C}(\text{C}_6\text{H}_5): \text{C} : \text{NCOOH}$ , was obtained by action of carbon dioxide on the magnesium derivative. It is an oil that is fairly stable at low temperatures but breaks down readily, when warmed, to carbon dioxide and the solid diphenylvaleronitrile. *3,4-Diphenylhexanone-2*,  $\text{C}_2\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{CH}(\text{C}_6\text{H}_5)\text{COCH}_3$ .—Diphenylvaleronitrile ( $115^\circ$ ) reacted readily with methylmagnesium iodide, giving two stereoisomeric ketones, one, stout needles melting at  $116^\circ$ , and the other melting at  $56^\circ$ . The oily modification of diphenylvaleronitrile gave a mixture of the same ketones. *Diphenylvalerophenone*,  $\text{C}_2\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{CH}(\text{C}_6\text{H}_5)\text{COC}_6\text{H}_5$ .—Two isomeric ketones were also obtained by using phenylmagnesium bromide. The higher melting ketone crystallizes in needles, melting-point  $170^\circ$ , soluble in acetone and



chloroform, sparingly in alcohol and ether. The lower melting one crystallizes in plates, melting-point  $92^{\circ}$ , soluble in alcohol and ether, sparingly in ligroin. II. *Phenylcinnamonitrile* and *Phenylmagnesium Bromide*.—These substances reacted slowly giving small yields of triphenylpropionitrile and benzaldehyoxybenzoin. *Triphenylpropionitrile*,  $(\text{C}_6\text{H}_5)_2\text{CHCH}(\text{C}_6\text{H}_5)\text{CN}$ , crystallizes in plates that melt at  $102^{\circ}$ . It is readily soluble in alcohol and ether, moderately in methyl alcohol, sparingly in ligroin. *Triphenylpropionamide*,  $(\text{C}_6\text{H}_5)_2\text{CHCH}(\text{C}_6\text{H}_5)\text{CONH}_2$ .—Needles, melting at  $213^{\circ}$ , readily soluble in alcohol, moderately in ether, very slightly in boiling water. Further hydrolysis carries it to triphenylpropionic acid. *Ethyltriphenylpropionitrile*,  $(\text{C}_6\text{H}_5)_2\text{CHC}(\text{C}_6\text{H}_5)\text{C}_2\text{H}_5\text{CN}$ . This body was obtained by the action of ethyl iodide on the magnesium derivative obtained from phenylmagnesium bromide. Fine needles, melting-point  $134^{\circ}$ . It did not hydrolyze when heated to  $200^{\circ}$  with concentrated hydrochloric acid. III. *Experiments with Cinnamonitrile* and  $\beta$ -*Phenylcinnamonitrile*.—Cinnamonitrile and methylmagnesium iodide gave benzalacetone; yield, 60 per cent. Cinnamonitrile and phenylmagnesium bromide gave a 68 per cent. yield of benzalacetophenone. A single experiment with  $\beta$ -phenylcinnamonitrile indicated that it acts like cinnamonitrile. With phenylmagnesium bromide it gave phenylbenzalacetophenone.

V. J. CHAMBERS.

**The Chemical Composition of Medicinal Plants.** BY EDWARD C. HILL. *N. Y. Med. J.* **83**, 659–662.—A review showing the general occurrence of such classes of substances as alkaloids, glucosides, resins, ethereal oils, tannins, etc.

V. J. CHAMBERS.

## BIOLOGICAL CHEMISTRY.

**The Effects of a Series of Poisons on Adult and Embryonic Funduli.** BY TORALD SOLLMAN. *Am. J. Physiol.* **16**, 1–47.—Funduli respond to a large variety of poisons by a simple, progressive paralysis, with few special symptoms. When the drug is placed in the water, the course of the poisoning is quite slow when the concentration is near the fatal limit; it can be materially shortened by increasing the concentration. Nicotine and digitalin act most rapidly. The concentration necessary to kill all the fish generally exceeds by one-third that required to kill two-thirds of the animals. The toxicity is generally twice as great in distilled water as in sea-water; with saponin, however, the reverse holds true, which is explained by the mechanism of its action. The toxicity of chloral and probably of nicotine and caffeine is the same in both media. Recently hatched fish are considerably more susceptible than adults to three of the poisons, much less susceptible to four; with six poisons the toxicity is the

same for both. The differences when present hold for both sea-water and distilled water. The addition of strychnine to other poisons does not lessen their effect. With four poisons there was no addition of the toxicity; with three a partial addition occurred. three others showed complete summation of the toxic effects. The development of early embryos is readily arrested by a number of poisons, but that of older embryos is not generally affected. Hatching, however, is often indefinitely delayed. The effects of poisons on the embryonic heart consist generally in slowing of the whole heart or especially of the ventricle. Two types of slowing may be distinguished: diastolic (chloral, potassium cyanide, saponin, nicotine and quinine) and systolic (barium chloride, digitalin, caffeine, physostigmine, pilocarpine, strychnine and veratrine). The concentration of the poison has a comparatively slight influence on the effects, within wide limits. The differences between solutions in sea-water and distilled water are similar to those observed with adults. The toxicity may vary with a number of the poisons before and after the appearance of the embryo. From the time when the heart appears until the approach of the hatching period, the toxicity remains constant. It is considerably increased at the time when the control specimens hatch. The course of the intoxication is generally very much slower, and the toxicity very much less, than with adults. This is due to the low permeability of the egg shell for the poisons. Drugs which penetrate readily are nearly as active as in adults. The penetration can be increased by saponin. Free alkaloids are not absorbed more readily than their salts. Potassium cyanide solutions produce in the younger ova a condition in which the development and the heart action are at a standstill, but during which the structure of the protoplasm and capability of resuming life is preserved. This condition lasts for several days. It was not observed in older ova or in hatched fish. It is presumably explainable by an inhibition of the autolytic metabolic processes which accompany death.

F. P. UNDERHILL.

**The Effects of Intravenous Injections of Extracts of the Bone Marrow of Swine on the Blood Pressure in Dogs.** BY ORVILLE

HARRY BROWNE AND DON R. JOSEPH. *Am. J. Physiol.* **16**, 110-

117.—The bone marrow of swine contains substances which exert

pressor and depressor influences on the blood pressure of dogs.

The pressor substance is soluble in 0.9 per cent. sodium chloride

solution at 45° C. and at boiling temperature. It is not soluble

in glycerol or is destroyed by it, and is only partially soluble in

alcohol or is partially destroyed by it. The depressor substance

is soluble in 0.9 per cent. sodium chloride solution at 45° C. and

also at boiling temperature; it is soluble also in alcohol and

glycerol. The first injection of 0.9 per cent. sodium chloride

solution extracts made at 45° C. produces a slight increase of

blood pressure, followed by a very marked and prolonged fall. The initial rise was not nearly so marked as that produced by later injections, while the fall was more marked both in depth and duration. Second and later injections produced a marked but short increase in blood pressure, also a deep fall; but this fall was broken by a second pressor effect which brought the pressure again above the normal where it remained for some time. It was replaced in from one-half to four minutes by a second depressor effect, which was gradually overcome, and the pressure gradually attained a level, usually somewhat below the normal, where it remained constant. The boiled extract produced on first injection both pressor and depressor effects very similar to those obtained by second injections of the cold extract; the second and later injections had practically the same effects as the first injection, except that the time occupied before the pressure regained a normal level was much decreased. The effects of marrow extracts on the blood pressure can be most easily explained by the assumption that there are two separate pressor substances and one depressor substance present in the marrow. One of the pressor substances acts instantly on introduction into the blood vessels, and the other acts only after a minute or so. The pressor begins with its action immediately after the first pressor effect, and reaches its maximum effect shortly afterward, only to be overpowered by the second pressor action. This latter is spent while the depressor substance is still potent.

F. P. UNDERHILL.

**The Relation between Contractility and Coagulation of the Colloids in the Ctenophore Swimming Plate.** BY RALPH S. LILLIE. *Am. J. Physiol.* **16**, 117-129.—Artificially accelerated contractile activity in the swimming plates of the *Ctenophore Eucharis lobata* is accompanied by visible coagulative alterations in the contractile fibrils. During movement in the normal medium (sea-water), and in artificial solutions in which movement retains its normal rhythm, no such coagulation occurs. Rapid vibratory movements induced by various solutions (*e. g.*, of weakly acidulated sodium salts) are invariably accompanied by rapid coagulation, this change being the more rapid the more energetic the contractile activity. In inactive plates it does not occur. A connection between contractile activity and coagulative changes in the colloids of the contractile tissue is thus indicated. Presumably, the contraction phase of the beat is due to a coalescence (incipient coagulation) of colloid particles; this change is reversed during the relaxation phase. During accelerated movement the reversal is complete, and the coagulation is therefore progressive.

F. P. UNDERHILL.

**Lactic Acid in Intermediary Metabolism.** BY ARTHUR R. MANDEL AND GRAHAM LUSK. *Am. J. Physiol.* **16**, 129-147.—



Lactic acid disappears from the blood and urine in phosphorus poisoning when phlorhizin glycosuria is induced. This indicates that lactic acid produced from the cleavage and denitrogenization of proteid, whether this occurs in the intestinal wall or in the liver, or elsewhere, is first synthesized to *d*-glucose within the organism (liver) before further distribution to the tissues. In the case of simple phosphorus poisoning this distribution of glucose takes place with resultant anaerobic cleavage leading to a second production of lactic acid. When diabetes is present, or when for any reason glucose is converted only as far as the lactic acid stage, or when the mammary glands utilize glucose to form milk-sugar, then the cells affected become "sugar-hungry cells" which attract fat in greater quantity than they can burn it (fatty infiltration). This picture of what is common to these conditions represents the standpoint developed in previous papers from this laboratory. There is a partial conversion of *i*-lactic acid into glucose in the diabetic organism. It appears that one-half and more of the lactic acid is so transformed while the rest burns and reduces proteid metabolism. There may be a complete conversion of *d*-lactic acid into glucose in the diabetic organism. There is never any considerable reduction of proteid metabolism indicative of a general combustion of a *d*-lactic acid when this is administered to a phlorhizinized dog. F. P. UNDERHILL.

**The Paths of Excretion for Inorganic Compounds. II. The Excretion of Barium.** BY LAFAYETTE B. MENDEL AND DUDLEY F. SICHER. *Am. J. Physiol.* **16**, 147-152.—There is a close resemblance between the salts of barium and strontium in their mode of excretion from the animal body. Barium introduced subcutaneously in the form of the soluble chloride in non-lethal doses is eliminated to a very small extent only by the kidneys, a detectable excretion through this channel ceasing within a few hours. Barium is eliminated to a larger extent with the faeces, being conveyed from the circulation into the alimentary tract. The actual quantities leaving the body by this path at one time are small; the process may continue for a long period and considerable amounts of barium may be deposited in the organism. F. P. UNDERHILL.

**The Paths of Excretion for Inorganic Compounds. III. The Excretion of Rubidium.** BY LAFAYETTE B. MENDEL AND OLIVER E. CLOSSON. *Am. J. Physiol.* **16**, 152-160.—These observations show many points of resemblance in the behavior of rubidium salts and those of lithium and caesium. All of them may be excreted by way of the intestine as well as through the kidneys. By far the greater quantity, however, appears to leave the body in the urine, in marked contrast with the conditions prevailing after the introduction of strontium or barium chloride as shown in the earlier papers in this series. (Mendel and Thacher, *Am. J.*

*Physiol.* 1904, **11**, p. 5, Mendel and Sicher, *Am. J. Physiol.* **16**, 147, see preceding abstract, this *Review*). F. P. UNDERHILL.

**Note on Equilibrium in Solutions of Phosphate.** BY LAWRENCE J. HENDERSON. *Am. J. Physiol.* **16**, 188-189.  
F. P. UNDERHILL.

**The Clinical Significance of the Urinary Nitrogen.** BY JAMES EWING AND C. G. L. WOLF. *Am. J. Med. Sci.* **131**, 751-772.  
F. P. UNDERHILL.

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### SANITARY CHEMISTRY.

**A Method for the Direct Determination of Organic Nitrogen by the Kjeldahl Process.** BY A. ELLIOTT KIMBERLY AND M. G. ROBERTS. *J. Infectious Diseases, Supt. No. 2*, February, 1906, 109-122.—The direct determination of organic nitrogen in sewage and sewage effluents was studied by McGowan (Fourth Report Royal Committee on Sewage Disposal 4, Part 5, p. 35) and though found by him at times to yield very satisfactory results in the analysis of very pure effluents, and frequently in others containing as high as 5 parts per million of nitrogen as nitrates, yet for general work upon sewage and sewage effluents it was found to be unsatisfactory, seemingly because, when considerable amounts of nitrified nitrogen were present, a portion of the organic nitrogen was oxidized by the nitric acid present, forming lower oxides of nitrogen. Phelps (*J. Infectious Diseases*, 1904, p. 327) outlined a process which he used with somewhat indifferent success owing to turbidity interfering with the color in the nesslerizing tubes. Kimberly and Roberts, in their work on Columbus sewage, have studied the cause of the disturbing turbidity in the nesslerizing tubes, and describe a method, a modification of McGowan's method which gave satisfactory results with Columbus sewage. The chief causes for appearance of turbidity are found to be: Insufficient preparatory treatment of the sample, whereby there results a precipitation of calcium carbonate or of magnesium hydroxide, and, in general, the formation by the alkali of the Nessler reagent of any other precipitate whatsoever save the normal colloidal mercury ammonium iodide; the use of caustic soda containing organic matter; the presence of a manganous salt from the use of permanganate in the digestion; the presence in the nesslerized tubes of calcium as sulphate in hard sewages above 50 parts per million, and, further, the neglect to mix thoroughly the solution before nesslerizing, even in cases where the calcium in a tube containing a homogeneous solution would be below the limiting value of 50 parts per million. Their method for the determination of the organic nitrogen is outlined as follows: An amount of sewage containing between 0.0005 and 0.0010 gram of

nitrogen is placed in a digestion flask and after the addition of 5 cc. of sulphuric acid, heated until the liquid is colorless or in the presence of iron shows only a pale yellow color, which becomes colorless when the liquid has cooled. The liquid is transferred to a 50 cc. flask and made up to 50 cc. at room temperature. Twenty-five cc. of this solution are transferred to a 100 cc. flask and an amount of prepared sodium hydroxide solution, not quite sufficient to neutralize the acid, added. The solution is then further cooled by surrounding the flask with ice water, and the sodium hydroxide solution added drop by drop until a flocculent precipitate is plainly visible, then 2 cc. of a sodium carbonate solution (1 to 10). The liquid is made up to 100 cc., passed into a tall 125 cc. glass stoppered bottle and allowed to stand six hours with occasional shaking to insure settlement of the precipitate. Ten cc. of the clear liquid thus obtained are transferred to a 50 cc. Nessler tube and nesslerized. The result obtained is in terms of total unoxidized nitrogen, from which the amount of organic nitrogen is obtained, by subtracting the nitrogen of the free ammonia, also determined by the direct process. The sodium hydroxide solution, free from organic matter, used for neutralization, is prepared by dissolving 250 grams sodium hydroxide in 1000 cc. of distilled water, heating the solution to boiling, adding drop by drop a strong solution of potassium permanganate until the liquid has a permanent green color and continuing the boiling till the solution is free from ammonia.

LEONARD PARKER KINNICUTT.

**The Relative Applicability of Current Methods for the Determination of Putrescibility in Sewage Effluents.** BY GEORGE A. JOHNSON, WILLIAM R. COPELAND AND A. ELLIOTT KIMBERLY. *J. Infectious Diseases, Supt. No. 2*, February, 1906, pp. 80-96.—A brief historical résumé of the various modifications of the "Incubator Tests" for the determination of putrescibility, of special chemical tests for the determination of putrescible compounds in sewage effluents, and notes of experiments made at Columbus to determine if at least an approximation of the putrescible character of a sewage effluent could be obtained from the ratio existing between the consumed and available oxygen in the effluent. The oxygen consumed, as determined by the amount of potassium permanganate reduced in three minutes by an acid solution of the sample at room temperature, was taken as a measure of the amount of putrescible matter, and the available oxygen which tended to prevent the establishment of putrescible conditions, was considered, the dissolved oxygen and the oxygen of nitrites and nitrates, but not the oxygen of sulphates. From the data obtained in the experiments made the authors state that they believe it is admissible to interpret the putrescibility of an effluent in the following manner. First, when the consumed oxygen value is equal to or in excess of the dissolved oxygen, no



nitrites or nitrates being present, the sample will putrefy. Second, when the consumed oxygen value is equal to or slightly less than the available oxygen contained in the effluent, the sample may or may not putrefy. Third, when the consumed oxygen value is less than the oxygen of the nitrites and nitrates, under ordinary circumstances the sample will not putrefy. In conclusion the authors say that though the above deductions admit of extended application at Columbus, they do not wish to be misunderstood as contending that they will prove of general application under all conditions, but rather that they will serve as a basis for further study. In respect to the amount of oxygen consumed by a sewage effluent, it was found at Columbus that the amount of permanganate reduced in three minutes at room temperature was just one-fifth of the amount reduced in five minutes at 100°.

LEONARD PARKER KINNICUTT.

**A Comparative Review of Current Methods for the Determination of Organic Matter in Sewage.** BY GEORGE A. JOHNSON AND A. ELLIOTT KIMBERLY. *J. Infectious Diseases, Supt. No. 2*, February, 1906, pp. 97-108.—A review and discussion of the different methods for estimating the amount of organic matter in sewage, and of Kjeldahl's process for total nitrogen. Nitrogen as albuminoid and free ammonia, oxygen consumed, and volatile matter. The conclusions reached are: "That more satisfactory practical results may be obtained by the Kjeldahl process than by the use of the albuminoid ammonia process, the results of which are uncertain percentages of the total organic nitrogen present in sewage and in effluents. That the direct process for the estimation of the ammonia formed in the Kjeldahl method seems practical and reliable above 0.5 part per million organic nitrogen. Below this amount the distillation method of Palmer is available. That the direct determination of nitrogen as free ammonia is accurate; and various modifications of the process may be used according to local hardness conditions. That although governed largely by local conditions, the oxygen consumed test, with its many modifications, is to be considered of great value in the examination of crude and purified sewages. That regarding the loss on ignition, the indications are that the total and volatile suspended matters, as determined by the Gooch process, are more reliable and give more satisfactory data for sewage problems than either the total volatile matters in the sewage or effluent or the indirectly determined total and volatile suspended matters. That none of the current methods for the determination of organic matter distinguish between stable and unstable organic matter, and that only by resorting to one of the various methods for the determination of putrescibility can information be obtained regarding the putrescible and non-putrescible matter in partially purified sewage, and even under these conditions there is indicated

only the relative predominance of putrescible and non-putrescible substances. It seems to be in this direction that the need is most urgent for methods applicable to the determination of the organic matter in crude and purified sewages."

LEONARD PARKER KINNICUTT.

**The Practical Advantages of the Gooch Crucible Method in the Determination of the Total and Volatile Suspended Matter in Sewage.** BY A. ELLIOTT KIMBERLY AND HARRY B. HOMMON. *J. Infectious Diseases*, Supt. No. 2, February, 1906, pp. 113-135.—This method was first suggested by Thomas and Hall, this Journal, 24, 538 (1902) and described in detail by McGowan, Fourth Report Royal Committee on Sewage, Supt. 4 and 5, p. 47. After numerous comparative analyses made by this process and by the standard platinum dish evaporation method, results of which are given with full details as to manipulation, the authors state that not only does the Gooch crucible method shorten the time required for the determinations, but that the results obtained are much more accurate, especially as regards the volatile suspended matter.

LEONARD PARKER KINNICUTT.

**An Often Neglected Factor in Sewage Analysis.** BY ELLEN H. RICHARDS. *Technology Quarterly*, 18, 142-145.—The neglected factor is a failure to take into account the rapid changes that the organic matter in sewage undergoes when kept at normal indoor temperature and the author believes that an incubation of twenty-four or thirty-six hours before testing is likely to give more concordant results and to lead to a better balance between applied sewage and effluent. Analyses of sewage made immediately after being taken from the sewers, and again after standing several days, are given, showing the amount of change that had taken place. One series of analyses made of sewage which had been treated with aluminum hydroxide when received, gave comparatively little increase of nitrogen as free ammonia on standing three days, indicating that the easily putrescible substances may perhaps be removed by treatment of sewage with aluminum hydroxide, which, if found as a rule to be the case, might give a new method for determining the character of the organic matter.

LEONARD PARKER KINNICUTT.

**The Sanitary Value of a Water Analysis.** BY LEONARD PARKER KINNICUTT. *Science*, January 12, 1906, 56-66.—The author states that while with surface waters it can be generally determined by a careful survey of the water-shed whether or not a given water is polluted by sewage, a sanitary analysis is necessary to determine the amount of pollution, and the changes which the polluting substances have undergone. That with ground and artesian waters the survey alone cannot be depended upon to show pollution, as the source of the pollution may be very distant

from the well or spring, and that often the only data from which an opinion regarding such waters can be obtained are those obtained by a sanitary analysis. That, to say, as has been said of late, "that there is no value in the sanitary analysis of a water" is, at least, an assumption that cannot be substantiated. The author then shows that a sanitary analysis of a water must include both the chemical and bacterial data, and gives his opinion as to the interpretation that should be given to the data thus obtained.

LEONARD PARKER KINNICUTT.

**The Scientific Disposal of City Sewage. Historical Development and Present Status of the Problem.** BY C. E. A. WINSLOW. *Technology Quarterly*, 18, 317-333.—An excellent popular statement of the chief processes used for disposal of sewage; dilution, land treatment, intermittent filtration, septic tank treatment, contact bed, percolating filters, etc. The progress that has been made in England, Germany and the United States is briefly mentioned and a short account is given of the experiments carried on on Boston sewage at the Sewage Experimental Station of the Massachusetts Institute of Technology.

LEONARD PARKER KINNICUTT.

**Sewage Purification Plant, Marion, Ohio.** BY GEO. H. PIERREN. *Eng. Rec.* 53, 358-362.—Population 15,000. Sewerage on separate system. The purification plant consists of a covered septic tank, 10 feet in depth, divided into three units of 2,000 sq. ft. each. Total capacity 450,000 gallons, aerating chamber, six contact beds, total area 30,000 sq. ft., filled to the depth of 4 feet with graded limestone, lower foot, average diameter 3 inches, upper three feet  $1\frac{1}{2}$  to  $\frac{3}{4}$  inches diameter and six intermittent filtration beds, total area 31,200 sq. ft. The novel points of the plant are, ventilation of the septic tank by a large flue, connected directly with the tall chimney of the Refuse Incineration Plant, which is adjacent and the construction of the intermittent sand beds, depth only 3 feet, filling material 8 inches of Lake Erie sand laid on top of 2 feet of gravel, and broken stone  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches diameter covering underdrains.

LEONARD PARKER KINNICUTT.

**The Microscopic Estimate of Bacteria in Milk.** BY FRANCES H. SLACK. *Technology Quarterly*, 19, 37-40.—The examination of the sediment obtained by the centrifugalization of milk shows that the number of bacteria found in the microscopic field bear a definite relation to the number of colonies developing in twenty-four hours, dilution 1/10,000, on an agar plate incubated at 37° and as a rough estimate it may be stated that each coccus, bacillus, diplococcus or chain, in the 1/12 oil immersion field, represents one colony in the 1/10,000 plate from the same sample. The milk to be tested is placed in small glass tubes, holding 2 cc. each closed at both ends with rubber stoppers and centrifugalized



for ten minutes at a speed of from two to three thousand revolutions per minute. The sediment obtained is spread on a space of 4 sq. cm. dried at a gentle heat, and stained with methylene blue. The microscopical examination of a milk sediment thus prepared gives the approximate number and the morphology of the bacteria, and the presence of pus or streptococci. Twenty-two hundred samples of milk examined by this method for the number of bacteria showed that an error of less than 1 per cent. was made in deciding whether or not milk contained less than 500,000 bacteria to the cubic centimeter, when compared with the agar plate method, and over a third of the total error occurred in the first 420 samples before the method was fully developed.

LEONARD PARKER KINNICUTT.

**Methods of Bacteriological Examination of Milk.** *J. Infectious Diseases, Supt. No. 2, February, 1906, 214-222.*—For collecting samples sterilized test-tubes are used. These are carried, with large pipettes for transferring the milk from containers to the test-tubes, in a case made of copper with double walls, divided into three compartments, the central one for the test-tubes arranged in small racks, the other two for ice. In plating, the methods recommended by the Bacteriological Committee (*J. Infectious Diseases, Supt. 1, 1905, p. 1*) are used. For the plate culture the agar medium is used and the plates are incubated in a saturated atmosphere for twenty-four hours at 37°. Comparison of plates grown at room temperature with those grown at 37° has at times shown great differences in the number of colonies developing in duplicate plates. These differences, however, have not been uniform, the higher or lower temperature developing more colonies according to the nature of the organisms present. Incubation at 37° has been adopted, since it allows a much quicker report; it gives each sample the same treatment at a regulated temperature, and it allows a fair comparison of results obtained over long periods. If the plates are incubated forty-eight hours, a slightly higher average count will be obtained, not enough, however, to materially change the report. Spreaders are to a large extent prevented by using porous earthenware petri dish covers as suggested by Dr. Hill. For counting, a four inch reading glass, magnifying about two diameters is used. It is fitted into an opening in a box which has an open bottom and glass front, the box being placed over the petri dish. The petri dish is placed on a child's school slate on which is cut a circle four and a half inches in diameter, and divided into ten equal segments. For microscopic examination the sediment from 2 cc. of milk obtained by centrifugalizing is spread over a space 4 sq. cm. and after drying and staining with methylene blue, is examined with a 1/12 oil immersion lens. Since pus cells and dead leucocytes are identical, it is impossible to differentiate them with the 1/12

oil immersion lens, and opinions differ as to the number of such cells that indicate pus. A fair standard for market milk is not over 50 such cells to the  $1/12$  immersion field. Streptococci are present in small numbers in most market milk and a milk is not condemned by the Boston City Board of Health for occurrence of streptococci unless the following three tests are all positive: (1) Microscopic examination of the sediment shows streptococci, diplococci, or cocci. (2) The plate from the same sample shows colonies resembling streptococci colonies in excess of 100,000 to 1 cc. (3) The broth culture from these colonies shows streptococci alone or in great excess of the other bacteria present.

LEONARD PARKER KINNICUTT.

**Experiments with Typhoid Germs at the Columbus Testing Station.** BY GEORGE A. JOHNSON. *Eng. Record* 52, 344.—An account of experiments made at the Sewage Testing Station regarding the passage of typhoid fever bacteria through parchment sacks. In the first series of experiments the sacks were filled with a 5 per cent. solution of starch, and immersed in half gallon bottles containing water, the bottles being plugged with cotton, one end of the sack protruding. The bottles were then autoclaved, and 1 cc. of a broth culture of *B coli* introduced. The water outside the sacks was tested for starch and *B coli* with negative results. After twenty-four hours on being again tested, *B coli* were found in all cases, but no trace of starch. In the second series of experiments the sacks were filled with sterilized water and proved to be sterile. They were then placed in flowing streams of sewage and polluted water. Inside of twenty-four hours *B coli* were found in all of the sacks. The following table gives the exact results obtained.

**RESULTS ILLUSTRATIVE OF ESCAPE OF *B. COLI* THROUGH WALLS OF PARCHMENT SACS IMMERSSED IN STERILIZED WATER.**

Time sacs were suspended in sterilized water.	B. coli per cc. in water surrounding sacs.		
	Sac A.	Sac B.	Sac C.
0 hours.....	0	0	0
24 hours.....	over 1000	over 1000	over 1000

**RESULTS ILLUSTRATIVE OF PASSAGE OF *B. COLI* THROUGH WALLS OF PARCHMENT SACS FROM OUTSIDE.**

Sacs suspended in flowing stream of	B. coli per cc. in water contained in sacs. Number of hours sacs were exposed in current.		
	0.	48.	72.
Crude sewage.....	0	320	2000
Septic sewage.....	0	320	2000
Septic sewage.....	0	120	1100
Eff. of a sewage filter.....	0	400	2000
Polluted water.....	0	0	40

The dialyzing properties of all the sacks used in the above experiments were carefully tested at the beginning and at the end of all the experiments, and were found unimpaired in all cases. The result of these experiments taken in connection with the

conflicting data obtained by Dr. Frost, Dr. Jordan, Dr. Russell and Dr. Zeit in their experiments on the life of typhoid fever germs suggest to the author the possibility that collodion sacs offer less opportunity for the passage of the highly motile typhoid bacilli than sacks of parchment, or the possibility that in the experiments made in connection with the Chicago Drainage Canal case, that after several days' service the initial integrity of the parchment sacks was impaired so as to allow the escape therefrom of the typhoid bacilli.

LEONARD PARKER KINNICUTT.

## INDUSTRIAL CHEMISTRY.

**The Thermo-chemistry of Portland Cement Burning.** BY RICHARD K. MEADE. *Chem. Eng.* February 1906, 203-217.—The chemical changes taking place in the burning of Portland cement are, the driving off of the mechanically held water, the combined water, the loss of carbon dioxide, organic matter and the sulphur present as sulphide. At higher temperatures, silica and alumina unite with lime; the sulphur present as sulphate is expelled, the alkalis are volatilized and the iron oxidized. These changes are partly exothermic and partly endothermic. Under the first heading are the burning of the sulphur and carbon, and under the second class are the decomposition of the calcium and magnesium carbonates. It is uncertain as to whether the combination of lime with the silica and alumina is exothermic or endothermic.

Tables are given, showing the heat required and given off in the various reactions, and finally summed up to show that in the making of one barrel of cement, requiring 600 pounds of dry material, 20.35 pounds of coal are theoretically needed. There are, however, a considerable number of losses; for instance the heat from about 65.8 pounds of coal is carried off in the waste gases and by the clinker. If these waste gases are used for boiling water, etc., and the heat is carefully taken out from the slag, it might be expected that 30 pounds of coal, such as Fairmount or Westmoreland gas slack, would be sufficient.

It is stated by some that from 100 to 150 per cent. of excess of air is required in the burning. The author, however, believes that with 17 per cent. excess of air, the operation can be carried out.

To utilize the waste heat, the following suggestions are made:

To lengthen the kiln, thereby giving greater time for the material to absorb the heat of the kiln gases or pass the excess from an ordinary short kiln through an upright boiler and then through an economizer. Edison has used a kiln as long as 150 feet, which is believed to have fairly well used the excess heat. From reliable data, it is stated that the 150 by 7 foot kiln should turn out 500 to 600 barrels per day with a coal consumption of 75 to 80 pounds



per barrel. With an 80 by 7 foot kiln, with dry material, 250 to 300 barrels per day can be turned out with a coal consumption of 90 to 95 pounds per barrel.

In utilizing the heat of kiln gases under boilers, considerable difficulties have been encountered, but recently Prof. R. C. Carpenter, of Cornell University, has carried it out successfully at the plant of the Cayuga Lake Cement Company and also at that of the Cosmos Portland Cement Company. At the Cayuga Lake Company plant, each two or 4 kilns are connected with a vertical water tube boiler, built by Wickes Brothers Manufacturing Company, with 3,000 square feet of water heating surface.

The author states that the use of 150 foot kilns would not yet bring the excess down to a temperature that would be most suitable for good boiler practice, namely 400° F., and from his calculations, believes that a kiln of at least 250 feet of the same diameter would have to be used to get the desired results.

S. S. SADTLER.

**Rosin Oil.** BY CHARLES HAY SPAYD. *Chem. Eng.* Feb. 1906, 218-224.—In this article the author gives a clear idea of the outline of the manufacture of rosin oil, stating the chemical application of the different fractions; for instance, an ordinary distillation of about 5,000 or 6,000 pounds of rosin will yield the following:

- 0.5 per cent. to 1.0 per cent. water.
- 1.5 per cent. to 2.0 per cent. naphtha.
- 84.0 per cent. to 88.0 per cent. raw oil.
- 3.0 per cent. to 5.0 per cent. residuum or pitch.
- 6.0 per cent. to 8.0 per cent. other substances, gases, etc.

The author does not believe that the iodine figure gives much of an idea as to the oil, finding it to vary considerably with the time of standing, but from a long series of experiments he finds about three hours to be a most satisfactory time to allow it to stand.

The author has done considerable work upon the solubility of rosin and rosin oils, with a view to their analytical separation. Rosin oil dissolves quite freely in ethyl alcohol, and also in a mixture of phenol and glycerol; also in phenol, but not in glycerol alone. A mixture of phenol and alcohol acts as a solvent. When the proportion of alcohol is increased, the solubility decreases. Equal parts of phenol, alcohol and rosin are found to form a satisfactory solution.

The author states that nitric acid acts quickly upon certain rosin oils, but with great difficulty upon others, the reason for which he has not yet ascertained.

A number of tests are given to determine a means of separating paraffin oil from rosin oil, largely based upon the solution of the rosin oil in phenol and alcohol mixtures, which are supposed to separate out the paraffin oil. The author desires to continue

his work upon this, as with certain oils the separation has not yet been found satisfactory.

Examples of the methods used may be given as follows:

(1) Used—Paraffin oil.....	1.10 cc.
Rosin oil.....	0.10 cc.
Phenol.....	10.0 cc.
Found—Paraffin oil.....	1.0 cc.
(2) Used—Paraffin oil.....	0.30 cc.
Rosin oil.....	1.30 cc.
Alcohol.....	1.50 cc.
Phenol ..	1.50 cc.
Found—Paraffin oil.....	0.3 cc.

It is shown that even with four distillations there are still acid principles which show a decided saponification value. The thickening test is used to determine roughly the amount of rosin or rosin oil in linseed oil. If litharge, red lead or orange mineral is mixed with linseed oil and allowed to stand for several days undisturbed a thickening will take place if any rosin or rosin oil is mixed with linseed.

S. S. SADTLER.

**A Modern Illuminating Gas Plant.** *Chem. Eng.* Feb. 1906, 225-242.—This article deals in a very exhaustive way with a large modern plant, treating of the coal used, coal storage and coal handling machinery, and describes fully the benches and retorts which are all of very improved construction, being essentially banks of 8 retorts heated by the same flue. Of course the carbonizing of coal in these group retorts is very much more economical than in single retorts.

The drawing and charging of the retorts is carried out by compressed air in a somewhat similar way to the best coke oven practice, the coal, however, being thrown into the retort and distributed on the floor. The collecting of gas and other products such as tar and ammonia, is described, while the descriptions of the condensers, washers, scrubbers and purifiers are very complete.

The approximate composition of the gas obtained and the tests made, are given as follows: (1) analyses of samples of each cargo of coal received to determine moisture, volatile matter, fixed carbon, ash, sulphur, B. T. U. per pound, and iron in the ash; (2) determination of candle power, heating power, volumetric analyses, sulphur, ammonia, etc., in the various finished gases; (3) determination of moisture, ash, sulphur and heating power of coke produced; (4) fixed carbon and water in the tar produced; (5) fixed carbon and viscosity of pitch; (6) analyses of the distillate oils for naphthalene, etc.; and (7) the strength of ammonia liquor in the wells and in the storage tanks of the concentrator.

In addition to these tests, at times the following are made:

(8) chimney-gas analysis and pyrometric tests for the regulation of the furnaces; (9) tests of crude gas at different points to find the effect of condensing, washing, scrubbing and purifying in the various forms of apparatus; (10) routine tests of the 20 lots of oxide used in purifying the gas; (11) tests of gas oil, fittings and other purchases; (12) tests for control of by-product plant. Experimental work is also conducted on incandescent gas lamps and mantles and in various other directions.

About one-half the coke is sold to water gas plants and for manufacturing purposes, while a large amount is also sold for domestic purposes. As is well-known, retort coke is much more suitable for domestic use than oven coke, which is much harder. Other by-products besides coke are creosote, which is used for preserving timbers, and ammonia, which is sold in the crude form to the manufacturers of ammonia products. The gas is distributed under pressure of from 5 to 60 inches in "booster" mains and is then reduced to about 3 inches by means of governors at each district.

S. S. SADTLER.

**The Valuation of Hydraulic Cement.** *Chem. Eng.* Feb. 1906, 243-251.—The various kinds of cement are described, but the tests given are those for true Portland cement. Of the tests used, the cements are classed under two heads—those designed to show the strength of concrete made from cement, and those to show its endurance. Under the first head come tests for tensile strength, compressive strength, fineness of cement and time of setting. Under endurance tests come soundness tests and the results of chemical analyses which show the presence or absence of magnesia and sulphur trioxide, etc., and tests for gross adulterants.

All testing of cement, wherever possible, should be done at the mill to avoid the expense and trouble of re-shipment. As bins are filled at the works for examination, they should be sealed until tested. Sampling should be done with long tryers which may be made conveniently of inch wrought-iron piping, the cuts and description of this being given in the article.

S. S. SADTLER.

**The Elements of Chemical Engineering.** *Chem. Eng.* February, 1906, 266-280.—In this article the composition of well-known bricks is given, stock sizes of arch bricks, etc., a table giving the composition of fire-brick to form arches and circles. Reference is made to special refractory bricks in which magnesite, bauxite and chrome-ore are used for different purposes. Magnesite bricks, being basic, are used for copper, lead, nickel and silver furnaces, but should not be used where silica at high temperatures may act upon them. Chrome and bauxite bricks are used to line steel furnaces. Being very refractory, chrome bricks sometimes being used between magnesite bricks and silica brick backings.



Graphite and carbon bricks are sometimes used for special purposes.

The subjects of Portland cement and heating are briefly taken up while formulae are given for special cements such as water-proof, oil-proof, acid-proof and chlorine-resisting cements; also elastic cements such as those made from India rubber, gasket compositions and iron and stone cements.

The different kinds of glass are given with their special uses, and a table showing the composition of chemical glassware. Additional sections are those on stoneware, porcelain, etc., India rubber, hard rubber, ebonite, graphite and finally asbestos.

S. S. SADTLER.

**The American Chemist and the Gas Industry.** *Chem. Eng.* March 1906, 295-306.—Conditions bearing upon the position of chemists in the employ of gas companies are gone into, showing the improvement that have come into the gas business, due to enterprise, in very recent years. This is partly due to the stimulus given it by the competition given it by electric lighting.

While gas can be made by rule of thumb, the author states that the tendency in the future is to use every effort to carry out the manufacture scientifically. The commercial processes now used for the manufacture of gas are destructive distillation of coal or oil; the several applications of producer effects, such as water gas, straight producer gas and mixtures of water gas and producer gas; combinations of water gas with destructive distillation of oil (carburetted water gas); one or another of these gases to which is added the vapor of some fat hydrocarbon such as oil water gas, and gases from special sources like acetylene.

Rich gases, such as Pintsch and acetylene gases are only used for special purposes like car lighting. Fuel gases are at the other extremity of the scale, with the exception of natural gas, having practically no lighting power and low even in heating power. In many cases these gases are too lean to be profitably distributed, and are, therefore, produced where needed. Satisfactory small producers are still a desideratum. The best attempt in this line is the suction producer. The author states that the use of bituminous slack for producer plants is still to be successfully accomplished.

The use of hydrocarbons in the manufacture of lighting gas is discussed, while the characters of coal and coke and heating value, candle power of the gases in the retort and oven methods of gas manufacture are discussed, the author believing that both systems will still be improved, and hold their places for different purposes.

The list of tests that are used, or which it is desirable to have worked out for the gas industry are given, and make a valuable list for reference.

Determination of moisture, volatile matter, per cent. of ash

and composition of ash, sulphur, heating power and ultimate analysis.

Sampling coal.

Various apparatus for giving complete test for yield, candle power, tar, etc.

Determining specific gravity of coal.

Tests for cannel coal.

Complete description of tests for control of a recuperative-producer bench.  $\text{CO}_2$ ,  $\text{O}_2$ ,  $\text{CO}$  and  $\text{NH}_3$ , in waste products and producer gas; regulation of water supply to ash pit; temperatures of recuperators, etc.

Pyrometry methods. A dependable color scale, use and care of thermo-electric pyrometer, Seger cones and other pyrometers.

Continuous or recording carbon dioxide test for chimney gas.

Complete description of tests for control of carbonization in thin-layer retorts; for control of carbonization in coke oven, and for regulating relation between hydraulic main seal and exhauster vacuum.

Sampling gas.

Estimation of tar in gas at various points in condensing system.

Estimation of naphthalene, benzene, water, ammonia, cyanogen and sulphocyanogen, carbon dioxide, water and sulphur other than hydrogen sulphide.

Tests for regulating condensing temperatures to get best results, scrubbing to remove most carbon dioxide and most ammonia with least water, and for regulating oxide purification, including amount of air supplied.

Determination of free sulphur in "iron sponge."

Tests for regulating lime purification.

Standard methods for making and keeping turmeric paper, litmus paper, lead paper, etc.

Continuous hydrogen sulphide indicator or recorder.

Complete description of tests for control of producer gas manufacture, Pintsch gas, carburetted water gas, oil water gas, enriching any gas with oil.

Tests for benzene as enricher, carbide and acetylene.

Complete analysis of commercial gases.

Determination of benzene, heavy hydrocarbons and different paraffins.

Short method for determining nitrogen.

Determining specific gravity of gas.

Continuous indicator for oxygen, nitrogen and carbon dioxide.

Determining heating power of gas.

Apparatus, standards and methods for candle-power test, and complete description of a standard method.

Tests for amyl acetate and pentane for Harcourt lamp.

Use and limitations of jet photometers.

Tests of open flame and incandescent gas burners.

Methods of test for fuel gas appliances.

Analysis of coke.

Determination of ammonia in crude and concentrated ammonia liquor.

Standardizing volumetric apparatus and solutions.

Determination of carbon dioxide in ammonia liquor.

Special analyses of ammonia liquor.

Tests for controlling concentrator, testing lime, testing waste liquor, testing waste gases, ammonium sulphate plant, bitumens, other than coal tar products, used in paving.

Testing coal tar for water and free carbon.

Complete commercial analysis of coal tar.

Testing pitch and refined tar, light and heavy creosote oils, water gas tar for free carbon, water and oil.

Specifications and tests for crude petroleum, gas oil and naphtha.

Water analysis and corrosions.

Examination of miscellaneous purchases. S. S. SADTLER.

**The Elements of Chemical Engineering. II.** *Chem. Eng.* March 1906, 307-314.

*Containers for Liquids, Solids and Gases.*—Under the heading of tanks the calculations of strength, capacity, etc., of wooden, steel, reinforced concrete and porcelain tanks are given (the porcelain tanks being largely those made in one piece, although some are made in sections and bolted or cemented together).

Formulas for arriving at the thickness of plates used in tanks are given, although it is stated that the thickness is generally controlled by that of rigidity and not that of strength. Where a calculation would come 0.144 inch thick, it is necessary to use  $\frac{1}{4}$  or  $\frac{5}{16}$  inch plates for the purpose of rigidity.

S. S. SADTLER.

**Valuation of Hydraulic Cement. II.** *Chem. Eng.*, March, 1906, 328-336.

*Fineness.*—An important matter is stated under this heading, that cement must be at least 200 mesh or there is no coherence of the particles; that it is better to have the cement of which some was less than 200 mesh, while the bulk was considerably finer than one which just barely passed the 200 mesh. It is the particles much finer than 200 mesh that do the work of binding.

This matter of fineness is gone into at considerable length, methods of sieving and what might be considered as specifications as to size being given. Methods of determining specific gravity and the importance of the same are given in an exhaustive way.

*Detection of Adulteration.*—This is sometimes accomplished merely by the use of a 3-lens pocket magnifier. Particles of well burned clinker will appear black or brown in color, of a waxy or



vitreous lustre, and more or less spongy, resembling coke or gum arabic. These particles of clinker are always more or less rounded. Slag usually appears of a greenish or bluish color, the edges being much sharper than those of the bits of cement clinker. Limestone and cement rock are always more or less flattened, the latter appearing dark gray in color. These may also be detected by means of effervescence with dilute acids.

The use of a liquid of high density, such as methyl iodide solution of specific gravity 2.95, is sometimes made to detect particles of lower specific gravity than cement clinker. This method is that of Le Chatelier.

S. S. SADTLER.

**The Manufacture of Plaster of Paris or Stucco.** By C. O. BARTLETT. *Chem. Eng.* March 1906, 337-338.—The crushing of gypsum rock is effected in the ordinary jaw crushers to about one inch cube. It is then dried in a rotary direct-heat dryer in which the products of combustion do not pass through the material, because of the danger of coloration. After this it is ground to 80 mesh with French buhr stones, and is then calcined in special kettles, 8 feet high and 8 feet in diameter, with the stirrers driven by heavy gears. The material soon begins to boil when heated in this kettle, and may boil three times in succession. After the first boiling it may be used for ordinary purposes, although for fine work two boilings are required. Estimates of cost are given for the plant.

S. S. SADTLER.

**The Problem of the Combustion of Atmospheric Nitrogen.** *Electrochem. Metal. Ind.* April, 1906, 121-122.—In this editorial a general discussion of the problem of producing nitrogen compounds, such as ammonium nitrates, artificially is given dealing with the bacterial cultures for soil inoculation, the possibility of separating nitrogen from the air by means of lithium nitride ( $\text{Li}_3\text{N}$ ), the fixation by means of electric discharges and the formation of calcium cyanamide from the interaction of calcium carbide and nitrogen.

S. S. SADTLER.

**An Interesting New By-product Development.** *Electrochem. Metal. Ind.* April, 1906, 122-123.—Reference is made here to the working of cupriferous pyrrhotite in monster copper blast-furnaces, in which the sulphurous acid is used for the manufacture of sulphuric acid, after the complete scrubbing it gets in the long furnaces. Less than  $1\frac{1}{2}$  per cent. of coke is used in the charge. Gases from the furnace are from 6 to 7 per cent. sulphur dioxide.

S. S. SADTLER.

**Recent Developments in the Production of Nitrates from the Air.** *Electrochem. Metal. Ind.*, April, 1906, 126-127. — The description here given is largely that of the work carried out in Kristiania, Norway, by Prof. Birkeland and Mr. Eyde, brief

reference being made to several other operations that were not successful.

The electrodes used in this furnace are of copper and water-cooled to prevent their fusing. An arc is passed between the electrodes and distended by magnetic means to give the greatest possible surface to the air. Nitrous oxide is first formed, which combines with oxygen and forms nitrogen peroxide. The formation of this peroxide prevents the reversibility of the reaction, and to enable the air to react, which is effected only at lower temperatures, the arc is frequently interrupted, and thereby quickly cooled.

To render transportation charges as little as possible, the nitric and nitrous acids which are formed by the absorption of water in the towers, are converted into calcium salts and used for fertilizer purposes. The sodium compounds are not made on a large scale, because of the final impairment of the soil by the continual addition of the sodium salt. This calcium salt is called "Norwegian saltpetre."

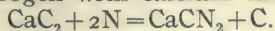
The calcium nitrate first formed, forms clear crystals with 4 molecules of water of crystallization. By further treatment a nearly anhydrous nitrate of lime is obtained with 13 per cent. of nitrogen. By the further addition of caustic lime a basic nitrate of lime is produced which is quite anhydrous.

At this works there are three furnaces of 500 kilowatts each, although the installation is being enlarged by the acquisition of other water powers, one of 25,000 horse-power, a second of 40,000 horse-power, and a third one still larger.

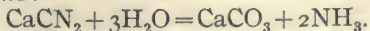
The cost of the water power which is obtained from other parties at present is \$8.20 per kilowatt year, but with the water powers that this company is developing, they expect to bring the power cost down to \$4 per kilowatt year. S. S. SADTLER.

**Fixation of Atmospheric Nitrogen.** By P. A. GUYE. *Electrochem. Metal. Ind.* April, 1906, 136-139.—It is stated that while the natural supply of Chili saltpeter will not last an indefinite time, to make an amount of nitrogen compounds equivalent to 1,000,000 tons of Chili saltpeter, which represents the annual consumption of Europe, the amount of nitrogen required would only be that contained in the atmosphere covering about 5 acres of the earth's surface.

One method of fixation is that which forms calcium cyanamide by the action of nitrogen with calcium carbide, as follows:



Acting upon the calcium cyanamide with water, ammonia is liberated as follows:



Calcium cyanamide, when distributed in the ground, gives off ammonia slowly, and is, therefore, found to be a satisfactory

fertilizer. In practice the calcium carbide is heated to about  $800^{\circ}\text{C}$ . when acted upon by nitrogen. Theoretically, the calcium cyanamide and carbon form in this reaction and should contain about 30 per cent. of nitrogen, while in fact it contains about 20 per cent., varying from 12 to 22 per cent. A kilo of fixed nitrogen in this form will cost about 14 cents, which is about on a par with nitrogen fixed in ammonium salts produced in the ordinary way.

A plant utilizing 3,000 horse-power will be opened this year in Italy.

The methods used for the fixation of nitrogen from the air by means of electric discharges are given with a very complete theoretical discussion of the subject, showing the reversibility of the reaction and giving the temperatures at which the nitrogen peroxide would form, which prevents the reversal of the primary reaction. The primary reaction proceeds more completely the higher the temperature, as follows:

Absolute temperature.	Percentages by volume of NO, observed.	Percentages by volume of NO, calculated.
$1811^{\circ}$	0.37 per cent.	0.37 per cent.
$2033^{\circ}$	0.64 " "	0.67 " "
$2195^{\circ}$	0.97 " "	0.98 " "
$3200^{\circ}$	5.0 " "	4.4 " "

The theoretical amounts of nitric acid that can be formed at several temperatures are as follows: 1850 kg.  $\text{HNO}_3$  at  $4200^{\circ}\text{C}$ .; 819 kg.  $\text{HNO}_3$  at  $3200^{\circ}\text{C}$ .

The best results that have been obtained are stated to be between 800 and 900 kg. per kilowatt year. The author, however, thinks that when all losses are taken into consideration, only about half of these figures are realized in practice.

To prevent the reversal of the reaction, the arc is made intermittent with interruption of several thousand times per second, thus quickly cooling the gases, the reaction space being continually exhausted.

With electrical energy at \$12 a kilowatt year, the energy required to produce 100 kg. of nitric acid would be about \$2.40, which shows a considerable margin of profit when 100 kg. of concentrated nitric acid are sold for \$9.00, and natural nitric acid in nitrates at \$7.00.

The use of liquid air is suggested for obtaining nitrogen on one hand, while the oxygen could be used for the producing of nitrates by the method just described where oxygen aids in the formation of nitrogen peroxide.

S. S. SADTLER.

**Containers for Alkaline and Lead Accumulators.** By M. U. SCHOOF AND C. LIAGRE. *Elektrochem. Metal. Ind.* April, 1906, 136-141.

*Containers of Sheet Iron and Steel.*—These vessels are made by



the following methods: folding, electric welding and welding with the oxyhydrogen flame, spinning, pressing and electro-deposition.

In folding, the best method is to place a copper wire between the two parts of the steel container. This is then nickel-plated or otherwise coated both inside and outside.

*Electric Welding and Welding with the Oxyhydrogen Flame.*—Description of means of electric welding and welding with the oxyhydrogen blowpipe are given. Combined spinning and pressing of boxes are described in which the vessel is first made circular, and then pressed to rectangular shape. With the method of hydraulic pressure, very satisfactory boxes are obtained, in which the metal is pressed by means of water, and such a pressure used that the metal in contact with the die is liquefied, the pressure being from 4,000 to 8,000 atmospheres in the inside of the cylinder.

Electrolytic deposition and the use of celluloid, hard rubber and sheet lead boxes are described. S. S. SADTLER.

**Factory Scale Experiments with Fused Electrolytes. I.** By E. A. ASHCROFT. *Electrochem. Metal. Ind.* April, 1906, 143-146.—The author describes the methods and furnaces found satisfactory by him in the electric deposition of zinc and lead from chloride solutions, and states that while neither of these operations is at present commercial, there are potential possibilities in the operations which should not be lost sight of.

In the electrolysis with fused electrolytes, it is generally quite necessary to have a very pure salt to start with, departing from ordinary metallurgical work, where the refining processes are successful. In this case, any impurities will accumulate and a dismounting and cleaning of the apparatus is very troublesome.

In the separation of zinc from chloride it is necessary to have heat generated from the inside, if iron or steel vessels are used, to prevent the alloying of the metal with the iron or steel container.

The electrolysis of zinc chloride with pure, anhydrous fused salt and with a fluid cathode is a very satisfactory process. The lining of the furnace is very satisfactorily made from zinc oxide and silicate of soda. The zinc in the bottom of the furnace acts as a negative electrode. A hole running through at one side on the bottom connects with the negative electrode on the outside of the cell, while an aperture running down from the top of the molten electrode to a lower level on the outside, forms an overflow tapping device. A cut of the apparatus is shown.

The temperature of the electrolyte is held at  $450^{\circ}\text{C}$ ., so as to be slightly above the fusing-point of zinc, which is  $410^{\circ}\text{C}$ .

The anode consists of a carbon block fused into the cell by means of molten lead, and a copper rod runs down into the electrolyte through a bell-shaped diaphragm.

In this furnace, the voltage is about 4 to 5 volts and the current

efficiency about 90 per cent. With the cheapest rate of water power at \$10 per horse-power year, the cost of operating will be about as follows: Electricity, \$7.15; upkeep and labor, \$2.50; total cost of operation \$9.65 per metric ton.

The cost of recovering lead from lead chloride would be about \$3 per long ton.

A description is then given of a vat for fused electrolyte, which is mechanically agitated, the magnetic field being without the lining and inside the casing of the cell. A full description is given, taken from the British patent No. 12,083 of 1905.

S. S. SADTLER.

### Factory Scale Experiments with Fused Electrolytes. II.

By E. A. ASHCROFT. *Electrochem. Metal. Ind.* May, 1906, 178-180.—In this installment, the author describes the electrolytic reduction of zinc sulphide and a molten bath of zinc chloride. Carried out at a temperature of 450° C., the zinc is obtained in molten form and sulphur distilled as vapor. J. Swinburne is the author of this reaction.

The desiderata of such a process of zinc recovery are given as follows:

Ores free from any harmful impurity which would contaminate the electrolyte.

Ores rich in blende and with little inert matter so as to avoid frequent cleaning out of the contents of the cell.

Cheap electrical energy near to the ores and the markets.

Efficient means for continuous agitation to prevent solid particles settling out on the cathode. The author doubts whether such conditions are likely to be met with as things are at present.

A similar reaction with lead sulphide is described. This is more promising. The considerations which are of importance in this case are:

(1) The occurrence of silver with the galena, which is an important credit in this work.

(2) The growing cheapness of electrical energy.

(3) The magnetic device of the author for agitation.

(4) The progress of modern concentration methods, which makes it possible to completely eliminate the iron.

A similar reaction is possible for sulphide of antimony,  $Sb_2S_3$ . Copper and iron sulphides are mentioned, but the reaction is not so defined, because of the reversibility of the reactions.

S. S. SADTLER.

**The Future of the Le Blanc and Electrolytic Alkali Works in Europe.** By JOHN B. C. KERSHAW. *Electrochem. Metal. Ind.* May, 1906, 173-174.—There seems to be a growing impression that the Le Blanc alkali process will be superseded by the ammonia soda process or the electrolytic processes. Attention is,

however, called to the practical statements of dividends, etc., of the most important companies operating the several processes. In the case of the important electrolytic process, the Castner Kellner Company, operating at Weston Point, Cheshire, a dividend of 4 per cent. was declared in the year 1904-5.

The Electrolytic Alkali Co., operating the Hargreaves-Bird electrolytic process, had a slight surplus which was used for arrearages on the preferred stock of the year before.

The United Alkali Company, controlling the LeBlanc works in the United Kingdom, declared a 7 per cent. dividend, while the Brunner Mond Company, operating the ammonia soda process (Solvay) at Winnington and Northwich, Cheshire, declared a dividend of 35 per cent. This would make it seem as if the ammonia soda process was, by far, in the best condition.

The writer, however, believes that the LeBlanc soda process is in quite a satisfactory position, due to the by-products, sodium sulphite coming into use now for making sulphur dyes, sodium sulphate, hyposulphite, sulphide, sulphuric acid, etc., being obtained, the alkali, carbonated alkali and bleaching-powder being subject to strong market competition.

In the electrolytic works, the substances that can be made from chlorine are the strong points of this process, taken together with metallic sodium and cyanide and peroxide. The Solvay process has little to fall back upon except the economy in the manufacture of carbonate and bicarbonate, the amount of by-product of calcium chloride having yet failed to find a satisfactory market.

S. S. SADTLER.

**A Remarkable Soda Spring.** BY J. A. EDDY. *Eng. Min. J.* April 28, 793.—This is an account of a spring in New Mexico, from which flows a practically saturated solution of sodium sulphate, weighing 10.66 pounds per gallon, at a temperature of 110° F. Crystallized sodium sulphate deposits around the spring have in time covered the valley, the crystallized salt crumbling to the anhydrous salt.

S. S. SADTLER.

**Brimstone Versus Pyrite for Wood Pulp Manufacture.** BY E. A. SJOSTEDT. *Eng. Min. J.* April 28, 1906, 803-804.—The writer takes issue with an article by Herman Frasch, in the same journal on December 23, 1905, and in which it was held that sulphur was the only suitable material for making bisulphite liquor.

The author shows that pyrite makes a gas of from 12 to 14 per cent. sulphur dioxide when fines are used, as compared with 12 to 16 per cent. sulphur dioxide in gases made by burning sulphur. In both cases most of the diluent in the gas is nitrogen from the air used in burning, but in the case of the brimstone gas there is about 7 per cent. of oxygen as compared with about



2 per cent. in the pyrite gas. The oxygen is regarded as disadvantageous as it forms sulphate in the liquor. The author admits that when pyrite of walnut size was used in the old-fashioned burners, it was not as economical as when brimstone was used.

The author's company made a comparative trial in which 3,000 tons of pyrite were used and 375 tons of sulphur. In comparing the sulphur and pyrite, the purity of the sulphur was taken as 98-99 and pyrite as 47 per cent. sulphur.

S. S. SADTLER.

### **Electrolysis: General Electrical and Lighting Protection.**

By H. W. SPANG. *Amer. Gas Light J.* May 7, 801-802.—A great many instances of destruction due to electrolysis are given.

In the main it is shown that moist earth is a very good electrical conductor and the current will frequently leave the poorly bonded return rails of electric railways and travel in some cases thousands of feet to other metallic conductors. As much as 3,000 amperes of current have been detected in underground pipes.

The writer claims that cement joints in pipes are not effective for insulation as lighting discharges are liable to break the connections. He also states that currents that pass off into the earth do not necessarily return *in toto* to the negative poles of the generators and act as static electricity.

The main means for improvement lies in having more adequate means for return currents as the ground generally offers about half the resistance of the average return circuits provided.

S. S. SADTLER.

**Alcohol Calorimeter for Coal Testing.** By PROF. W. M. WALLACE. *Amer. Gas Light J.* May 7, 802-803.—Some different makes of calorimeters are discussed with their attending disadvantages.

In the Thompson type it is claimed that the large bubbles passing up through the water can not give up all their heat to it.

The Carpenter type of instrument would be satisfactory except that the expansion of water which is to be measured is different at different initial temperatures of the air and water. The writer, therefore, suggests the use of alcohol, the expansion of which, due to the heat of combustion of the coal, can be measured with great accuracy at various initial temperatures. Burning only 0.6 gram of Welsh coal, a rise of alcohol of 30 inches may be effected in the observation tube.

S. S. SADTLER.

**Fire and Fire Risks.** *Amer. Gas Light J.* April 16, 671-672.—In discussing this subject with reference to the spontaneous ignition of coal, the article advances several theories:

(1) That some cause of initial rise in temperature should be found such as a steam pipe, flue, etc.

(2) That oxidation of the coal itself is the main cause of combustion.

(3) That air, which has been suggested to prevent ignition, may be only enough for promoting combustion, particularly on shipboard.

(4) That moisture facilitates combustion.

(5) Pyrites do not seem to play any important rôle.

(6) That fresh fractures before storing seem to be effective in causing oxidation of hydrocarbons.

(7) The best preventive is a small cylinder of compressed carbon dioxide fitted with a fuse plug melting at 200° F. A cylinder 1 foot long and 3 inches in diameter would be sufficient to fill the pores of 8 tons of coal.

S. S. SADTLER.

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### AGRICULTURAL CHEMISTRY.

#### **A Test for Saccharin and a Simple Method of Distinguishing between Cumarin and Vanillin.**

By J. H. KASTLE. *Public Health and Marine Hospital Service, Hygienic Laboratory, Bull. 26.*—Saccharin when heated with phenol and sulphuric acid fuses to a dark purplish red color which after cooling is soluble in cold water to a yellow color, changed to a purplish red color by the addition of sodium hydroxide. The author suggests a method based on this reaction for the detection of saccharin in foods. The reagent employed consists of a mixture of 5 cc. of phenol and 3 cc. of pure concentrated sulphuric acid. The saccharin is heated with a very small amount of this reagent for five minutes at a temperature of from 150° to 170°, the mass dissolved in a small amount of water, and rendered alkaline with 2N sodium hydroxide. The solution becomes dark purplish red or pink, depending upon the amount of saccharin present. Any great excess of the reagent must be avoided. With a small amount of saccharin the best results are obtained by intimately mixing with the smallest amount of the reagent that can be obtained on the tip of a small glass rod. A distinct reaction was obtained with 0.025 mg. of saccharin. The author calls attention to the fact that the same reaction would be obtained with orthophthalic acid and also orthosulphobenzoic acid which, however, differ from saccharin in not having a sweet taste, and are not found in foods. The reaction is not given by salicylic or benzoic acids. Cumarin gives no reaction with this method, but a reaction is obtained with vanillin even at ordinary temperatures, and becomes very pronounced at 100° C. Saccharin may be distinguished from vanillin by the fact that the former does not give a reaction at the temperature of boiling water. The following reactions were obtained by mixing saccharin with sulphuric acid and the phenols mentioned below, and heating for five minutes at from 160° to 170° C.

Name of phenol.	Color with alkali.
Pyrocatechol .....	Green.
Hydroquinone .....	Purplish brown, blue fluorescence.
Resorcinol .....	Salmon-pink, strong, greenish yellow fluorescence.
Trikresol <sup>1</sup> .....	Purplish red.
Phloroglucinol .....	Wine-red.
Thymol .....	Light blue.

With vanillin at 100° C. the following results were obtained:

Name of phenol.	Color with alkali.
Pyrocatechinol .....	Dark blue to green.
Hydroquinone .....	Purplish brown.
Resorcinol .....	Red, with slight greenish fluorescence.
Trikresol .....	Deep purplish red.
Phloroglucinol .....	Yellow.
Thymol .....	Light red.

W. D. BIGELOW.

**The Administration of the Imported Food Law.** BY W. D. BIGELOW. *J. Frank. Institute*, 1905.—A detailed description is given of the method of administering and the results of the administration of the Federal law regulating the importation of foods into the United States. The various forms used in tabulating and recording results are given. W. D. BIGELOW.

**Cattle Medicines.** BY THOMAS MACFARLANE. *Lab. Inland Revenue Dept. Ottawa, Canada, Bull.* 117.—The bulletin gives the results of the examination of 35 samples of condition powders of various descriptions. Results are given for the determination of total and soluble ash and soluble solids, microscopical examination and some special determinations. Owing to the lack of professed standards, or of any legal standards governing this class of products, their legality is not questioned. The value of the "universal cattle medicines" is questioned.

W. D. BIGELOW.

**A New Method of Making Dry Red Wine.** BY FREDERIC T. BIOLETTI. *Cal. State Expt. Sta. Bull.* 177.—Detailed directions are given for the manufacture of dry red wine by sterilization and fermenting with pure cultures. The results of Bulletin 167 of this station are verified and additional data given. W. D. BIGELOW.

**Bluestone and Formalin.** BY THOMAS MACFARLANE. *Lab. Inland Revenue Dept. Ottawa, Canada, Bull.* 115.—This bulletin gives the report of the examination of 23 samples of bluestone and 11 samples of formalin obtained in the open market. Many of the samples of copper sulphate contained more than the

<sup>1</sup> Trade name of an antiseptic mixture containing the three cresols in nearly equal quantities.



theoretical amount of cupric oxide, owing probably to the loss of some of the water of crystallization. Six of the samples contained less than 30 per cent, of cupric oxide, and the least contained was 28.62 per cent. In only one sample was a considerable amount of impurities detected. Of the 11 samples of formalin examined, 10 contained from 37 to 39.6 per cent. of formaldehyde. One sample contained but 25.6 per cent.

W. D. BIGELOW.

**Improving the Quality of Wheat.** BY T. L. LYON. *U. S. Dept. Agr. Bur. Plant Ind. Bull.* 78.—The results of an extended investigation on the improvement of wheat by the use of chemical methods are here included. The following are some of the results obtained. The smaller and lighter kernels contain the largest percentage of nitrogen, the total yield of nitrogen per acre exceeding that from the heaviest kernels. By continually selecting the smaller kernels for several generations, the yield is gradually increased so that it equals that produced by large and heavy kernels. The variation in the percentage of nitrogen in different plants in the same year is wide, varying in 1903 from 1.20 to 5.85. The analysis of a row of spikelets indicates the average composition of that spike. The ratio of gliadin to glutenin remains about the same, as the gluten content is increased. Of wheat kernels, grown under the same conditions, those which have a high percentage of proteid have a lower specific gravity, weigh less and occupy a smaller volume than kernels low in nitrogen. A determination of the nitrogen content in the kernels of one-half of the spikes on a wheat plant will give a good indication of the amount of nitrogen in the kernels of the other spikes. "The proportion of gluten to proteids in kernels of different wheat plants may vary considerably. A determination of proteid nitrogen is therefore not always a guide to the gluten content of the wheat." In plants that contain a high percentage of gluten, the percentage of other proteids is relatively small. The percentage of proteid nitrogen, the weight per kernel and the total nitrogen production are hereditary qualities. Early maturing plants give largest yields, but the grain has a slightly lower percentage of nitrogen than a later maturing plant. The bulletin is divided into two parts; one, historical, in which is found the results of the work of previous investigators, and the other experimental in which the results enumerated above are given.

J. A. LECLERC.

**Buckwheat.** BY J. L. STONE. *Cornell Agr. Exp. Sta. Bull.* 238.—Buckwheat is the least important of the grain crops, the states of New York and Pennsylvania producing more than two-thirds of the entire crop of the United States. This bulletin gives a "general account of the buckwheat plant," the methods of its cultivation, the soil requirements, the preparation of the

soil, etc. There are three chief varieties, the common gray, the silver hull and Japanese. The weight per bushel varies from 40 to 56 pounds. The composition is as follows:

	Grain. Per cent.	Flour. Per cent.	Hulls. Per cent.	Straw. Per cent.	Middlings. Per cent.
Water .....	12.6	14.6	10.1	9.9	12.7
Ash .....	2.0	1.0	2.0	5.5	5.1
Protein ( $N \times 6.25$ ).....	10.0	6.9	4.6	5.2	28.1
Fiber .....	8.7	0.3	44.7	43.0	4.2
N-free extract.....	64.5	75.8	37.7	35.1	42.4
Fat....	1.2	1.4	0.9	1.3	7.0

The percentage of nitrogen and of nitrogen-free extract is lower than in the case of wheat. Middling is a valuable dairy food on account of its high percentage of protein and fat while the hulls are so hard and indigestible that they are not often used.

J. A. LECLERC.

**Collaborative Work on Tannin Analysis.** BY F. H. SMALL. *Shoe and Leather Reporter*, 82, No. 18, 68.—A general review of the work of the Association of Official Agricultural Chemists of the American Leather Trades Chemists Association, upon methods of analysis and of valuation of tanning materials.

F. P. VEITCH.

**Determination of Free Acids in Tan-liquors.** BY LOUIS HOGREFE. *Hide and Leather*, 31, No. 18, 46.—The writer finds that the charcoal method used is defective both in theory and practice. He submits the following method as an improvement. He has verified it by numerous experiments: 12.5 cc. of tan liquor are mixed with about 5 grams of zinc oxide free from carbonate or soluble zinc salts, and water to make 200 cc., 20 grams of moist chromed hide powder are then added and the whole shaken for five minutes and filtered. 100 cc. of the filtrate are titrated with N/10 sodium hydroxide, using phenolphthalein as an indicator. Each cubic centimeter used corresponds to 0.10 per cent. of free acid calculated as acetic acid. Correction, however, must be made for free acid in the hide powder by titrating a blank sample. Correction, also, of course, must be made for the water in the hide powder used. These corrections are easy of execution. The theory of the method is that the zinc salts formed are decomposed by the N/10 sodium hydroxide, and since the zinc oxide thus formed during the reaction is neutral to phenolphthalein, the end reaction is distinct.

F. P. VEITCH.

**The Cocoanut and Its Relation to the Production of Cocoanut Oil.** BY HERBERT S. WALKER. *Philippine J. Sci.* 1, 58.—The influence of the soil upon the yield of nuts, copra and oil was first studied, as it had been observed that cocoanut trees growing near the shore produced much more fruit than those

growing inland. This study of the soil, however, showed that no material difference existed in the fertility and the increased production of the trees growing along the shore is attributed to the inexhaustible underground water supply in the sandy soil near the sea, from which the trees probably derive much plant food. In the study of the nut and oil production, the question of age in reference to quality, degree of ripeness, variety, and locality in which grown were investigated. From a number of analyses of nuts of different ages it was shown that there is a gradual increase in meat, copra and oil and a corresponding decrease in milk as the nuts increase in age up to full maturity. This increase in quality is further well shown by analyses of a large number of nuts from the same tree but of varying degrees of ripeness. There was also shown to be a marked decrease in the percentage of solids in the milk with increasing age. But little difference in quality was found in two different varieties growing side by side, the nuts of one variety being golden yellow and of the other, light green, and the same similarity in composition was shown to exist between nuts from trees growing along the seashore and those growing inland.

L. S. MUNSON.

**The Keeping Qualities and the Causes of Rancidity in Cocoanut Oil.** BY HERBERT S. WALKER. *Philippine J. Sci.* 1, 117.—Although it is generally stated that cocoanut oil has great tendency to become rancid, the experiments conducted in the laboratories at Manila showed that when once prepared in a pure state its keeping qualities are equal if not superior to those of most other vegetable fats and oils. Analytical results are given showing the increase in acidity of a number of sample in two, four and six months, and where the initial acidity was small, the increase in acidity for the different periods was unimportant. Most of the free acids and the accompanying bad taste and odor are produced in the copra itself before the oil is expressed. One oil from a sample of copra which had been cut into fine pieces and exposed to moist air for one month increased in acidity from 1.50 to 23.30 per cent. This hydrolysis accompanied by destruction of the fat is brought about by molds, acting either alone or in symbiosis with bacteria, the conditions most favorable to their growth being a moderately high, constant temperature, and a water content of from 9 to 17 per cent. No organisms were found on a sample containing 4.76 per cent. of water and no change in acidity took place. Ordinarily, commercial copra contains from 9 to 12 per cent. of water, a condition most favorable for mold growth. By comparing the various methods of drying copra on a commercial scale a hot air apparatus, either rotary or stationary, was found to be the most efficient, and the time of drying was reduced to from two to four hours. The author further observed that in addition to the development



of free acids by molds, many samples on long standing develop a noticeably acrid taste and odor without any marked increase in acidity. This process is shown to be a direct oxidation by the air and to depend largely upon the surface exposed. However, the action of light and air is of relatively little importance compared with the great changes produced by mold growth. No mention is made by the author of the possible influence of enzymes in causing an increase in acidity, although it seems probable that these bodies may also be important factors in causing the deterioration of this oil.

L. S. MUNSON.

**The Cuban Sugar Industry.** BY W. D. HORNE. *J. Chem. Ind.* 25, 161.—Of the 12,000,000 tons of sugar produced annually in the world, Cuba furnishes about 1,000,000 tons; except the small amount used on the island all of this is shipped to the United States and constitutes about 40 per cent. of the sugar consumed in this country. The principal cane belt of the island is the comparatively level strip of country near the coast and extending almost around the island. Ten successive crops are commonly harvested in as many years from one planting, the average yield being from 15 to 20 tons per acre. During this period the yield gradually diminishes and the density and purity of the juice increase. The Cuban factories are as a rule well equipped with modern machinery, the almost universal product now being a centrifugal sugar polarizing about 95.5° or 96.0° V. In extracting the juice, the cane is first passed through a crusher which removes nearly half of the juice; the crushed cane then passes through the mills which are generally three in number. Here an enormous pressure is applied and as the crushed cane leaves the first and second mills it may be macerated with water when the extraction becomes much more complete. When no macerating water is added a crusher and three rolls will extract about 72 pounds of juice from 100 pounds of cane. The strained juice is immediately treated with lime to neutralize acidity and precipitate impurities that form insoluble lime salts. This precipitate is removed by settling and by filtration. The clarified juice is concentrated in multiple effect evaporators to about 20° to 32° B, when it goes to the vacuum pan. Here it is further boiled "to grain" and either discharged into iron sugar wagons to cool slowly or into crystallizers when the mass is constantly stirred and thus cooled more rapidly. In either case the product is finally purged in the centrifugals, the molasses being further concentrated and a "second" sugar thus obtained. The residual molasses is often sold to local distillers for 2 to 3 cents per gallon, some is burned and more is run into streams or placed upon the land. But little is exported. The exhausted cane or bagasse is largely used as fuel at the factory.

L. S. MUNSON.

**Mineral Waters in the United States.** BY J. K. HAYWOOD.

AND B. H. SMITH. *U. S. Dept. Agr. Bur. Chem. Bull. 91.*—The bulletin takes up the classification and methods of analysis of mineral waters, and reports the results of a study of the composition of American mineral waters as sold upon the market and of Saratoga waters sampled at their source. In discussing the classification of mineral waters the authors consider the methods of Peale and of Crook the most satisfactory although in some respects these are weak or fail entirely; a more comprehensive classification is therefore suggested. While the composition of many of the mineral waters sold upon the market is materially different from their advertised composition it is pointed out that this difference may be due to a gradual but constant change in the composition of the water as it comes from the spring, or to poor analytical work on the part of the commercial chemist. In some cases there has apparently been fraud either on the part of the retail dealer or of the spring owner. In reference to the Saratoga waters sampled at their source it is noted that these waters now contain only from one-half to one-fifth as much mineral matter as they contained when analyzed about 1871 by Prof. C. F. Chandler, that there is a great variation in the total mineral content of individual springs from time to time, and that the rarer elements such as lithium and bromine seem to vary to a greater extent than the other elements present.

L. S. MUNSON.

**A Comparison of the Results Obtained by the Method of Cultures in Paraffined Wire Pots with Field Results on the Same Soil.** BY H. J. WHEELER, Director of the Rhode Island Station, and B. E. BROWN AND J. C. HOGENSON, Assistants, Bureau of Soils, U. S. Dept. of Agr. *Bull. 109, Rhode Island Agr. Expt. Sta.*—The soil used was from the permanent plots of the Rhode Island Station. Lime alone increased the yield as it does in the field work. Before liming, phosphorus gave some increase, while after liming this benefit disappeared and potassium and nitrogen increased the yield. Where all these elements were used with lime, the yield was less than where any two were used. This condition was reversed, however, as successive crops were grown. Where stable manure and nitrates were used together, denitrification evidently resulted. The benefit from green manuring and the relative effects of different carriers of phosphorus, as well as the beneficial effects of lime used with roasted redondite, agreed with the field work. The immediate and after effects of sodium and potassium salts agreed in the main with field results, but not in detail. The influence of liming in connection with both nitrate of soda and sulphate of ammonia was the same as that shown by field tests. "In general, the tests by the method of the paraffined wire pots show good agreement with field observations of a whole season's duration." J. H. PETTIT.

**The Absorption of Phosphates and Potassium by Soils.** By OSWALD SCHREINER AND GEORGE H. FAIRYER. *Bull. 32, Bureau of Soils, U. S. Dept. of Agr.*—Four widely different types of soil were used—Cecil clay, Penn loam, Podunk fine sandy loam, and Norfolk fine sand. An apparatus was so arranged that the sample of soil was held in a Pasteur-Chamberland filter and the flow of water or solution through it so regulated that about 50 cc. passed in twenty-four hours. The soils were first treated with distilled water to determine the effect of this upon the absorbed phosphates in the soils, then with a solution of monocalcium phosphate, and finally a second time with distilled water. Separate fractions were analyzed colorimetrically. "The successive solutions obtained by slow percolation of water through the four soils have been shown to have a concentration in phosphate which is practically a constant for any given soil,..... The soils studied, moreover, yielded solutions which differed little in concentration, except in the case of the Podunk fine sandy loam, which has a low absorptive capacity and is acted upon by water to an unusual extent. The absorption experiments with the phosphates have shown that at the start this is very rapid and complete, the strong phosphate solution being reduced to the concentration characteristic of the water solution for that soil. This seems to show that the application of considerable quantities of a soluble phosphatic fertilizer would not materially increase the concentration of the phosphate dissolved in the free soil water..... This absorption process is mathematically represented by the differential equation

$$\frac{dy}{dv} = K(A - y),$$

where  $K$  is a constant,  $A$  the maximum quantity the soil can absorb and  $dy$  the quantity it has absorbed when the volume  $v$  of phosphate solution has passed through the soil. The removal of the absorbed phosphate appears to be in general the same as the removal of the phosphate from the original soil, the concentration becoming constant when only a fractional part of the absorbed phosphate has been removed, and this concentration is practically that yielded by the original soil with a far less phosphate content. It would therefore seem that it is this absorptive power of the soil which controls the concentration of the phosphate in the free soil moisture." Similar results are shown in the potassium experiments. Absorption here is governed by the same law as in the case of the phosphates. "The absorbed potassium, like the absorbed phosphate, is continually diffusing into the free soil moisture and becoming, therefore, directly accessible to plants."

J. H. PETTIT.



## PATENTS.

NOVEMBER 7, 1905.

803,541. Peter Bergell, Berlin, Germany. Assignor to Aktien Gesellschaft für Anilin Fabrikation, same place. **Bromolecithin.** Obtaining by reacting on lecithin with bromine; a colorless mass-like wax, soluble in chloroform, alcohol and ether, slightly soluble in acetone and water, easily saponified by heating with alcoholic soda-lye, and digesting but less readily than lecithin.

803,543. Anson G. Betts, Troy, N. Y. **Oxidizing by electrolysis.** A solution of a ferrous salt is electrolyzed together with a soluble salt of copper which is reduced to a metallic state by a carbon anode in constant motion, a ferric salt being produced.

803,557. Charles H. Claudel, Argenteuil, France. **Generating gas.** Assignor to Compagnie du Carburateur Claudel, Paris, France. A hydrocarbon liquid is vaporized and dissociated by heat and at the same time the burnt gases from a gas engine are mixed with the vaporized hydrocarbon.

803,566. Ralph Ditty, Cleveland, Ohio. **Core compound.** Flour 40, gypsum 24, sawdust 5, salt 4, and dextrin 1 part. Used in molding metals.

803,601. Edward F. Kern, Lansingburg, N. Y. Treating **anode slimes.** Arsenic and antimony are oxidized by heating in air, the arsenic volatilized as arsenious acid, the antimony made an oxide and the copper extracted as a sulphate.

803,632. Berthold Singer, Chicago, Ill. **Dust absorber.** Sodium chloride 15, oil 5, cement and sawdust 10 parts each. Used to collect dust from floors while sweeping, etc.

803,647. Wm. Warr, Staleybridge, England. Assignor to Calico Printers Association, Manchester, England. **Magnesian mordant.** The fibers are treated with magnesium sulphate and the hydroxide precipitated by sodium silicate, the goods being then dyed by substantive colors.

803,651-2-3. Herman C. Woltereck, London, England. Assignor to the Eschweiler-Woltereck Process Syndicate, same place. **Synthetic ammonia.** A mixture of air, steam and a reducing gas is heated to between 300° and 400° C. and passed over a large surface of iron heated to the same temperature.

803,774. Fritz Mayer, Mayence, Germany. **Dialkylmalonyl-urea.** A biuret is made to react on a dialkylmalonyl halide, as diethylmalonyl chloride.

803,792. Samuel B. Sheldon, Buffalo, N. Y. Using **flue dust.** Three to 5 per cent. of flue dust is mixed with coal and the mixture coked.

803,802. John W. Ball, Woodbine, W. Va. **Brazing compound.** Muriatic acid 12, zinc 3, water 4, and powdered borax 2 parts.

803,816. Wm. L. R. Emmet, Schenectady, N. Y. **Insulating material.** Sheets of asbestos paper are dipped in a mixture of boiled linseed oil, gum copal, and turpentine, dried, consolidated by heat and pressure and baked.

803,855. Julius Ribbert, Hagen, Germany. **Dyeing indigo resists.** The goods are saturated with a reducing compound, then with an ordinary paste resist such as is used for printing blue, applying indigo color, then dyeing and washing the goods.

803,886. Carleton Ellis, New York, N. Y. Treating **iron ore.** The ore is subjected to a flame of high heat intensity between which and the ore a reducing flame is maintained, charged with carbon.

803,887. August Falk, Vienna, Austria-Hungary. Removing **nicotine** from tobacco. The nicotine-containing articles are suspended in a closed vessel which protects them from the radiant heat of the furnace walls, the temperature being raised to 150° to 193° C., the rising vapor being condensed on a water-cooled cover, and the condensed liquid led outside the vessel, the operation being continued till the nicotine is removed.

803,902. Edgar P. Hooley, Nottingham, England. Assignor to Tarmac, Limited, Spring Vale, England. **Tarmacadam.** Hot blast-furnace slag 200, tar 12, pitch 1, and resin 3 parts, all mixed hot.

803,904. John G. Jones, Carthage, New York, N. Y. **Hydrating lime.** Burnt lime is slaked with an excess of water, forced into a filter-press, to remove a large per cent. of water, and the filter cakes dried in moist air and powdered.

803,920. Frederic W. Moffett, Bloomfield, N. J. Assignor to Howard M. Thomas, same place. **Antifriction metal.** Lead 98 and magnesium 2 parts.

803,921. As above. **Alloy.** Lead and sodium, the latter 1 to 2 per cent.

803,945. Moriz Weinrich, Yonkers, N. Y. Assignor to Wilhelm Baur, N. Y., and Carl Portius, Caro, Mich. Treating **sugar beets.** The beets are pulped and mixed with enough cold milk of lime to make them alkaline, then heated till entirely defecated, and the juice extracted by pressure.

803,952. George E. Woodward, Boston, Mass. **Non-inflammable celluloid.** Celluloid 100, fish glue 150, gum arabic 40, gelatin 10, and rape oil 4 parts.

804,006. Paul Guhrs and Albert Guhrs, Berlin, Germany. **Zinc alloy.** One-half to 2 per cent. of aluminum is added to

zinc together with a little tin to make a good coating alloy, which does not make "hard zinc."

804,010. Julius F. Kenkel, Milwaukee, Wis. Assignor to Geuder and Paeschte Manufacturing Co., Milwaukee, Wis. **Enameling.** A mixture of clay and an oxidizing acid as acetic is applied to a steel or iron article to which it adheres in spots, the article being shaken to mottle it, while moist; it is then coated with a glaze coat, and fused on.

804,016 Alfred B. Latting, Memphis, Tenn. Revivifying **spent fuller's earth, etc.** The clay is pulverized, heated in contact with a flame while hot air is forced through it to burn out the grease, etc., it has absorbed.

804,021. Ernst Marquardt Schöneberg, near Berlin, and Hermann Viertel, Charlottenburg, Germany. Making **oxides of nitrogen.** Apparatus consisting of a system of pipes, means for making an electric arc in said pipes between carbon electrodes coated with calcium fluoride, and supply pipes for oxygen and nitrogen.

804,034. Paul E. L. Perdrizet, Paris, France. **Artificial pearls.** Gelatin is dissolved in a minimum quantity of water, molded, dried, moistened and again dried and the mass which now resembles a "baroque," is mounted on a rod for convenience in handling.

804,038. George N. Piper, Cleveland, Ohio. **Photographic process.** A sensitive film is applied to a base transparent to transmitted light but opaque to reflected light, the plate exposed in the camera so that the rays from the object pass first through the base, developing the negative, washing out the portions acted on by light and transforming the remaining portions to a sulphide. An image is obtained positive to light, shade and position.

804,157. Rudolph Muller, Höchst-on-Main, Germany. Assignor to Farbwerke Meister, Lucius und Brüning, same place. **Hydrosulphite mixtures.** A mixture of an alkali hydrosulphite 1000, acetone 115, caustic alkali 54 cc. of 40° B., and ammonia 52 cc. of 35 per cent. is evaporated till dry, the product being readily soluble in water, reducing indigosulphonic acid slowly in the cold but rapidly when heated.

804,186. Louis J. Drabek, Turner, S. Dakota. Treating **ore slimes** of gold, etc. A cyanide solution is added to the slimes in one tank; they are then washed into another, and a barren solution added and they are then washed into a third and the values recovered with water. A barren solution is one from which the gold has been removed.

804,191. Max Fremery, Oberbruch, and Emil Bronnert, Mulhausen-Niedermorschweiler, Germany, and Johann Urban, St. Polten, Austria-Hungary. **Cellulose threads.** Ammonia-



copper cellulose is treated with strong alkali, the solid product is separated and immersed in caustic alkali, and finally washed and dried.

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804,358. Edward B. Weed, Cleveland, Ohio. Assignor to Weed Distilling and Manufacturing Co., New York, N. Y. **Terpenes from wood.** The wood is heated in a bath of rosin till the desired products distil over.

804,400. Daniel H. Haywood, New York, N. Y. Assignor to the Fowler Co., New York, N. Y. **Separating oil from water.** An apparatus for separating oil, a receiver containing a solvent for oil heavier than water, but of a lower boiling-point as  $\text{CCl}_4$ , a supply tank for the mixture above the receiver and a pipe connecting with the lower part thereof, and a clear water discharge at the upper part of the receiver.

804,441. Peter Stiens, Rotterdam, Netherlands. Apparatus for making **generator gas**. A generator chamber is divided horizontally in the middle by a grate holding the coal and forming an upper and lower chamber, a feed pipe entering the upper chamber, a pair of transverse pipes communicating with the lower compartment and perforated pipes connecting the transverse pipes in the lower compartment.

804,450. John Campbell, Chicago, Ill. **Tanning process.** The hides are soaked in a solution of tannin and sodium nitrate.

804,455. Chester Comstock, Brooklyn, N. Y. **Lubricant.** A powdered lubricant of 8 parts graphite and 1 part soft soap.

804,515. Paul Askenasy and Martin Mugdan, Nuremberg, Germany. **Separating hydrochloric and sulphuric acids.** Sulphurous acid and chlorine are fed into one end of a reaction chamber, and a solution of hydrochloric acid and water at the opposite end, so that a stream of sulphuric acid free from hydrochloric acid flows off one end of the chamber and a stream of hydrochloric acid gas free from sulphuric acid passes off from the chamber.

804,516. As above for **acetylene tetrachloride**. Acetylene and chlorine are caused to react alternately on antimony chloride, whereby acetylene chloride may be fractionated off.

804,524. Max Elb, Dresden, Germany. Freeing **yeast extracts** from bitter principles. Yeast extract is evaporated one-half, then 100 cc. of hydrogen peroxide are added to each kilo of the yeast, the mixture boiled and the resulting precipitate removed.

804,555. Rudolf Schenk and Paul Marquart, Cassel, Germany. Assignors to Chemische Fabrik Bettenhausen, Marquart and Schultz, Bettenhausen, Cassel, Germany. **Red phosphorus.**

White phosphorus is dissolved in pure phosphorus tribromide, undiluted, and the mixture heated, whereby red phosphorus free from white phosphorus is made that is highly reactive and is pure.

804,610. Hugo Lieber, New York, N. Y. **Radioactive salve.** A salve vehicle like vaseline is exposed to thorium emanations till it has absorbed so much of said emanations in its mass as to become therapeutically active.

804,664. Maximilian Leisel, Cologne, Germany. **Soldering paste.** Finely powdered soft solder, glycerol and ammonium chloride, the latter forming a coating for the particles of metal.

804,682. Rudolf J. M. Sommer, Vienna, Austria-Hungary. Assignor to the firm of Franz Fritzsche and Co., Hamburg-Uhlenhorst, Germany. **Protocatechuic aldehyde.** Heliotropin is dissolved in alcohol, an excess of sodium bisulphite added with a large excess of water, the mixture heated under less than twelve atmospheres of pressure or near that, and a temperature of 190° or below, and then separating the protocatechuic aldehyde formed.

804,690-1-2-3. Utly Wedge, Ardmore, Pa. **Desulphurizing iron pyrites** for use in blast-furnaces. Pyrites smalls are mixed with a metallic sulphate as ferric sulphate, then the mixture granulated or briquetted with clay or Portland cement, and fused at a low temperature.

804,718. Robert Gottwald, Goldenberg, Germany. **Chamoising fur skins.** The furs are first soaked in alum solution, then in sour bran mash containing copper sulphate, and finally given a chamois tanning.

804,737. Edward Krenz, St. Louis, Mo. **Illuminating gas.** A body of bituminous coal is ignited within a fire pot and made red hot, fresh fuel is piled on in the fresh fuel chamber and the smoke withdrawn above the flame; steam and air are injected into the bottom of the red hot mass, while the gas is sucked from a point above said mass but below the new fuel, and below the smoke openings.

804,785. Utley Wedge, Ardmore, Pa. **Desulphurizing pyrites.** Pyrites smalls are mixed with sodium nitrate and briquetted. Sulphate of iron may be added. See 804,690, etc.

804,808. Charles I. Goessman, Worcester, Mass. Assignor to Vellumoid Paper Co., Amherst, Mass. **Strong impervious paper.** Paper is saturated with gelatin and treated with formaldehyde.

804,817. Charles L. Reese, Wilmington, Del. Assignor to Eastern Dynamite Co., Wilmington, Del. **Nitroglycerol.** An alkaline fluoride is added to both the acids and the glycerol,

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804,850. Charles L. Ireson, Boston, Mass. **Leather and rubber bodies.** Articles of manufacture comprising a body of leather impregnated with sulphur and a body of rubber vulcanized by heat united by an intermediate cold vulcanized section.

804,851. Same. **Attaching rubber to leather.** Leather containing sulphur and rubber previously vulcanized by heat which are to be united have their uniting surfaces treated first with a thin coating of ordinary rubber cement and with a solution of sulphur chloride which forms a vulcanizing agent. The surfaces to be united are then brought together under pressure.

804,853. Same. **Attachment of rubber and leather.** Leather is freed from substances likely to be injurious to rubber and is supplied with a vulcanizing compound like sulphur chloride. Between the leather and rubber to be united is interposed a sheet of vulcanizable rubber compound and the whole subjected to heat and pressure.

804,894. Anders M. Soderlund, Goteberg, Sweden. Assignor to Gosta Gabriel Gustafsson Oxenstierna, Philadelphia, Pa. **Burette.** With a graduated burette is combined a reservoir within which is a pipe which opens into the air and communicates with the reservoir at its lower end only. There is a discharge opening from the pipe connection between the reservoir and the burette and a two-way stop-cock connects them.

804,936. Willis E. Everette, Tacoma, Wash. **Metallurgical process.** The pulverized materials are subjected to the action of liquid oxygen by which they are reduced to a rigid condition and made to occlude a part of the oxygen. In this condition they are forced through a suitable melt which has been already prepared and heated to incandescence, whereby the sulphur and phosphorus are removed and the metals rapidly fused.

804,960. Leonhard Lederer, Sulzbach, Oberpfalz, Germany. **Lacquer or varnish.** An acidilized cellulose as acetyl cellulose is dissolved in acetylene tetrachloride.

805,001. Colonel E. Bright, Columbus, Ohio. **Food product.** A mixture of beef fat, lean of beef, and corn meal, the entire fat content of the food comprising between 10 and 15 per cent. stearin.

805,009. W. E. Everette, Tacoma, Wash. **Making hydrochloric acid.** Water, chlorine gas, compressed air and a chloride of an alkali metal are reduced to an intense crymic condition by liquid air; while in this condition the mixture is subjected to intense heat by causing impact against incandescent silica, disruption of the substances taking place. The hydrochloric acid gas which is formed is dissolved in water,



805,017. Thomas B. Joseph, San Francisco, Cal. **Metal-leaching process.** Such metals as gold, silver, copper and nickel are extracted from their ores when in suitable condition by subjecting them to the action of a solution containing water, sodium cyanide and an excess of ammonium carbonate. The metals are then precipitated by any of the known methods. In addition to sodium cyanide and ammonium carbonate the leaching solution may contain ammonium nitrate, calcium hydroxide and sodium bicarbonate, and compressed air be employed.

805,031. Ernest O. Schmiel, Leipsic, Germany. **Preparation of zinc and aluminum plates.** The surface of the plate is rubbed over with acetic acid before the drawing is applied, and after the drawing has been produced it is etched with a saturated solution consisting of equal parts of acid oxalate of potassium and gum arabic.

805,081. Tadeusz von Lewicki, Warsaw, Russia. **Treating vegetable juices.** Albuminous bodies, relatively free from foreign substances, are obtained from vegetable juices, as in the manufacture of sugar, by adding to them a sufficient quantity of an alkaline base to unite with and neutralize the organic acids, and free the albuminous bodies which are then coagulated and separated.

805,095. Ambrose Ridd, Newport, Ky. **Making oxide-coated sheet metal.** Rust-proof sheet iron is prepared by depositing throughout its surface while in a heated condition a layer of fine powdered ferric oxide in the dry state, and then passing it through heated rolls, whereby a "Russia" sheet iron is made.

805,139. Halbert K. Hitchcock, Walton, Pa. Assignor to himself and Charles W. Brown, trustees, Pittsburg, Pa. **Manufacture of glass.** The more refractory materials like silica and lime are heated separately, the impurities being removed from the silica thereby, and the temperature being that at which the less refractory materials will unite with the more refractory ones. A fluxing alkali is added to the melted silica in a fluid condition after the first is melted, and a homogenous glass results.

805,143. Ernest König, Höchst-on-Main, Germany. Assignor to Farbwerke vorm. Meister, Lucius & Brüning, same place. **Cyanin dye.** This product is made by heating with alkalis in a suitable solvent a mixture of two quinoline salts, one of which contains a methyl in the alpha position in the pyridine nucleus and the other an alkyl linked to the benzene nucleus in the 5-position. It is brilliant green to bronze-colored crystals, readily soluble in hot water, alcohol and chloroform with a violet color; less soluble in cold water, insoluble in ether, benzene and ligroin; the aqueous solution is decolorized on adding diluted mineral

acid, but reassumes its color on adding alkali; on shaking the aqueous solution with chloroform the latter absorbs the dye readily and completely.

805,242. Ernest Stöffler, Zurich, Switzerland. **Fire-proof quartz block.** Sand or its equivalent is mixed with magnesia alone as a binding material, the bricks molded and hardened by steam and then burned.

805,260. John G. Callan, Lynn, Mass. Assignor to General Electric Company. **Insulating bushing.** An insulating material like cellulose acetate is applied in the liquid condition, the wire is then stretched to lessen its diameter and the coating when hard is removed from it in tubular form.

805,285. George E. Grehard, Paris, France. **Preserving compound.** Hydrochloric acid (13 per cent.) 200, silicate of soda 200, phosphate of soda 2, sugar 2, and water 600.

805,302. Richard Kück, Hanau, Germany. Assignor to the firm of W. C. Heraeus, same place. **Quartz glass free from air bubbles.** Rock crystal is slowly heated to 600° C. and the pieces then heated to vitrification by exposing to the oxyhydrogen flame to melt them together.

805,304. Same. **Protecting quartz glass vessels.** The vessels are given a protecting coat of carbon on the inside by passing into them a current of a gaseous hydrocarbon, and heating the walls of the vessels from without until the quartz glass softens.

805,316. Herschel C. Parker, New York, N. Y. Assignor to Parker-Clark Electric Company, Jersey City, N. J. **Producing metallic iridium.** Compounds of iridium, chlorine and ammonium are highly heated in the presence of an ammonium compound, as the chloride, in a refractory substance, whereby the volatile matters are driven off and the metallic iridium remains.

805,366. Simon Kohn, Vienna, Austria-Hungary. Assignor of one-fourth to Gustav Pollak, same place. **Textile fiber material.** Fiber material which consists of animal tendons which have been reduced to fibers, by rubbing, etc., impregnated and tanned.

805,382. Walter M. Sanders, Iola, Kans. **Concentrating ores.** The ore is subjected to a non-acid solution containing a sulphate of an earth metal as ferric sulphate and capable of evolving a gas, and such particles as are sustained by the gas are collected.

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805,443. Friedrich Boleg, Cannstatt, Germany. Assignor to Gesellschaft zur Verwertung der Boleg'schen Wasserlöslicher Mineralöle und Kohlenwasserstoffe, Gesellschaft mit Beschränkter Haftung, Berlin. **Preparation of water-soluble vaselin.**

To melted vaselin is added 10 to 15 per cent. water-soluble mineral oil at a temperature of  $40^{\circ}$  to  $50^{\circ}$  C. and intimately mixed while cooling. This water-soluble mineral oil is an ozonized solution of mineral oil in rosin soap.

805,456. Charles A. Ernst, Landsdowne, Pa. Assignor to Silas W. Pettit, Philadelphia, Pa. **Bleaching artificial silk.** The silk is subjected to the action of an oil, such as Turkey-red oil, at a temperature of about  $40^{\circ}$  to remove the soluble sulphur compounds, and is then bleached in a solution of sodium hypochlorite to which a small quantity of acetic acid has been added.

805,466. Ferdinand Hünenbein, Baltimore, Md. **Surface compound.** For finishing wooden or other surfaces a compound composed of gum copal 50, benzene 10, para rubber 5, and celluloid 2 parts, intended to be mixed with varnish.

805,470. Eleazer Kempshall, Boston, Mass. Assignor to Manhattan Manufacturing Co., Portland, Me. **Covering metallic bodies.** A metal body piece is faced with a celluloid substance which is plastic when subjected to heat and pressure, and having distributed therein strands of fibrous material whose interior spaces are only partially filled with the celluloid substance.

805,501 and 805,502. Edward R. Taylor, Penn Yan, N. Y. **Producing chemicals in electric furnaces.** The electrodes of the furnace consist of fragmentary conductive material fed into the respective sides of the furnace, downward and toward each other by gravity. The material for a given reaction is fed down, upon and between the electrodes through which the electric current is made to pass. A mixture of crushed sulphur and carbon is thus treated for the production of carbon disulphide.

805,553. Martin Hölken, Barmen-Ritterhausen, Germany. Assignor by mesne assignments to Fürst Guido von Donnorsmarck, of Neudeck. **Improving paper yarn.** The yarn is dipped for a short time in a finishing material and is immediately treated under tension in a brushing machine, the brushes of which are supplied with paraffin, wax, fat or the like.

805,555. Noak V. Hybinette, Westfield, N. J. **Refining copper-nickel matte.** The matte is roasted to form oxides and then leached with weak sulphuric acid whereby copper sulphate is extracted; it is then heated with sulphuric acid to a temperature where the anhydrous sulphates do not exist and leached with weak sulphuric acid. Next heated with hydrochloric acid to a temperature sufficient for the partial decomposition of the anhydrous chlorides, and leached with a weak acid, if necessary, obtaining a nickel oxide suitable for refining by ordinary methods.

805,560. Simon W. Kohn, Cleveland, Ohio. **Germicidal**



**cake.** Consists of a solid soluble germicide adhering to a fusible insoluble adhesive, like naphthol and beeswax.

805,563. Horace W. Lash, Cleveland, Ohio. Assignor to the Garrett-Cromwell Engineering Co., same place. **Manufacture of steel.** A portion of the final charge of the crude metal containing silicon and phosphorus is run into a basic-lined open hearth, while another portion is blown into an acid-lined converter until practically all the silicon has been removed; then it is transferred to an open hearth, the total carbon of the combined charge being sufficient to allow dephosphorization of the bath without carboniferous additions.

805,564. Same. **Manufacture of steel.** A portion of unrefined iron is supplied to an acid-lined converter and is blown until the silicon is oxidized, and the metal is changed with iron oxide. A second portion of the unrefined metal is supplied to a basic-lined open-hearth furnace, and to it is added the metal from the converter, while to the bath basic additions are made.

805,577. James Nicholas, Waterloo, Eng. **Treatment of ores.** Ores of zinc, lead and the precious metals are pulverized and mixed with water and with a chloride, and then heated with exclusion of air. The metallic compounds are then reduced to the metallic state, the lead and precious metals being heated with aluminum.

805,581. John D. Pennock, Syracuse, N. Y. Assignor to The Solvay Process Co. **Producing filling material.** Carbon dioxide and dry ammonia are passed simultaneously into a solution of calcium chloride, the temperature and action being continued until all the calcium of the solution has been precipitated as calcium carbonate.

805,595. Charles H. Thompson, Stourbridge, England. Assignor of one-half to Maw & Co., Jackfield, Eng. **Glass tile, etc.** The back of the slab is coated with a silicofluoride which is insoluble in water after dehydration, and then pieces of silicious material are sprinkled upon it and dried and warmed without fusing the silicofluoride, and gradually allowed to cool.

805,607. Michael Weyemann, Bamberg, Germany. **Tasteless malt decoctions.** Water and colored malt-groats are mixed and dry malt-groats rich in diastase added; the mixture is mashed and heated to about 150° F. and charcoal containing no water-soluble noxious substances added, the mash boiled and the decoction separated from the husks.

805,701. Ralph Baggaley, Pittsburg, Pa. **Recovering sulphur.** Sulphur-bearing fumes of smelting furnaces are passed through combustible screens of waste material which retain the sulphur, and which are subsequently burned, the sulphur being sublimed and collected.

805,712. Herbert H. Church, Bellows Falls, Vt. Assignor to Casein Company of America. **Preparing calcimine compositions.** Animal glue is dissolved in water by the aid of heat and a solution of soap is added. The mixed solutions are evaporated to thin films, which are pulverized and then mixed with a pulverized mineral or earthy base as talc or whiting or both.

805,743. Alexander H. McConnell, Wilmette, Ill. Assignor to Central Scientific Co., Ill. **Barometer.** The tube extends through the bottom of an inverted cup at the bottom of the tube which has a flange and a flanged base plate, with a ring that grips the edge of the plate and the edge of a flexible sack at the mouth of the cup, the said base plate having a set screw bearing against the sack.

805,835. Ralph Baggaley, Pittsburg, Pa. **Fluxing copper ores.** Metallic iron as a flux is charged into the copper-smelting blast-furnace.

805,836. Same. **Producing iron.** Fumes containing iron and sulphur from metallurgical furnaces are passed through a combustible screen, upon which is formed a crust of iron and sulphur-bearing material. The sulphur is removed by sublimation by burning the screen and the iron recovered from the residue.

805,854. Eric Hedburg, Joplin, Mo. Assignor to American Reduction Co., Chicago, Ill. **Magnetic ore separator.** A single vertical shaft carries two or more series of magnets with pole pieces forming inclosing shells, and separating rings of non-magnetic material, combined with spreader aprons to conduct the falling material in proximity to the magnets and means for rotating the magnets and for removing the adhering ores from the rotating pole pieces. The whole adapted to separate iron sand from non-magnetic sand.

805,890. Otto Sohst, Höchst-on-Main, Germany. Assignor to Meister, Lucius und Brüning, same place. **Diaminoformyl diphenylamine.** Dinitroformyldiphenylamine is reduced with iron in the presence of little acid, the base is separated from the excess of iron by means of the easily soluble sulphate, and then isolated by sodium acetate. The product is *p-p*<sub>1</sub>-diaminoformyl-diphenylamine of the formula  $\text{HCO}-\text{N}-(\text{C}_6\text{H}_4\text{NH}_2)_2$ , crystallizing from water in small crystals and soluble in almost all solvents.

805,903. George A. L. Clift, West Bromwich, Eng. Assignor to Robinson Brothers, same place. **Dissolving and recovering rubber.** Waste rubber is dissolved in a base of the pyridine group, and the solution then treated with an acid to separate the rubber from the base, and the solvent is then removed.

805,918. Thilo Kroaber, Basel, Switzerland, Assignor to the firm of Society of Chemical Industry, in Basel, same place. **Monoazo dye.** A monoazo dyestuff from 1-2-aminonaphthol-4-

sulphonic acid, and 1-8-dioxynaphthalene-3-6-disulphonic acid, which is soluble in water with a pure violet color, soluble in concentrated sulphuric acid with a greenish blue color, and dyes unmordanted wool in clear blue shades, which become bluish green on treatment with chromium compounds.

805,924. George Merling, Frankfort-on-Main, Germany. and Aladar Skita, Höchst-on-Main. Assignors to Farbwerke vorm. Meister, Lucius & Brüning, Höchst-on-Main. **4-4-Cyclogeranic acid.** Monochlordehydro-4-2,4-cyclogeranic ester is produced from isoprenecarboxylic ester and phosphorus pentachloride, and after saponification is treated with reducing agents. The new product, 4-4-cyclogeranic acid is readily soluble in alcohol, ether, benzene and acetone; from hot ethyl acetate or ligroin it crystallizes upon cooling in large, well-formed glassy prisms, which melt at  $103^{\circ}$ ; under 6 mm. pressure it boils at  $123^{\circ}$  without decomposition; the distillate is clear as water and upon cooling solidifies immediately to a hard crystalline mass.

805,969. Noak V. Hybinette, Westfield, N. J. **Separating metals.** Nickel is separated from copper by electrolyzing an anode consisting of an alloy of copper and nickel in a solution consisting of nickel sulphate and a weak acid, regenerating the solution and returning the same.

805,984. Mathias F. McNelly, Chicago, Ill. **Treating paint.** Mercuric chloride is thoroughly incorporated with sweet milk which is then heated and stirred into the paint.

806,006. Otto Ruff, Berlin, and Wilhelm Plato, Colberg, Germany. **Obtaining calcium.** A mixture of calcium chloride and calcium fluoride is electrolyzed at a temperature above the melting-point of calcium.

806,025. Wilhelm T. Unge, Stockholm, Sweden. **Fuses.** A combustion material for fuses or the like which is elastic, expansive and non-hygroscopic is produced by incorporating with a loose fuse material like black gunpowder a non-volatile greasing material such as olive oil and then compressing the mass.

806,045. Ralph Baggaley, Pittsburg, Pa., and Charles M. Allen, Lolo, Mont. Allen, assignor to Baggaley. **Converting matte.** To a converter having a non-silicious wall is applied a lining containing ore in predetermined amount; low-grade matte is added, a blast of air is blown in and the whole body of the lining consumed in the converting operation.

806,046. Same. **Converting matte.** Similar to above process, the converter in this case having a silicious wall, the lining applied of matte-making material being loose and containing sufficient silica to act as a flux.

WM. H. SEAMAN.



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WILLIAM A. NOYES, Editor.

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## GENERAL AND PHYSICAL CHEMISTRY.

**Colloids.** BY W. R. WHITNEY. *Trans. Am. Electrochem. Soc.* 7, 225-233.—A paper in which some of the more important properties of colloidal solutions are briefly summarized. It is pointed out how the principles underlying these solutions have found application in various fields of applied science, such as the chemistry of proteids, blood immunity and infection, dyeing of textile fabrics, coloring of glass, settling of slimes, cementing of clays, electrical endosmose, etc.

C. A. KRAUS.

**On the Specific Inductive Capacity of Oleic Acid and Its Salts.** BY LOUIS KAHLENBERG. *Trans. Am. Electrochem. Soc.* 7, 167-169.—The author determines the dielectric constant of oleic acid and some of its salts, at 20°, by Drude's method. For the acid the constant is determined at 2.50 to 2.60, while for some of the salts values are obtained as follows: ferric oleate, 2.68; aluminium oleate, 2.40; copper oleate (solid), 2.80; sodium oleate (solid), 2.75; lead oleate (solid), 3.27, at 18°. The constants for the solid salts are practically the same as those for the melted salts. A saturated solution of copper oleate in pyridine gives a constant of 10.5, the constant of pyridine being 12.5. The dielectric constant of a number of vegetable oils is likewise determined.

C. A. KRAUS.

**The Interdependence of the Atomic Weights and the Electrochemical Equivalents.** BY ARVID REUTERDAHL. *Trans. Am. Electrochem. Soc.* 7, 187-198.—This paper consists mainly of speculations based on the well-known relations between atomic weights and electrochemical equivalents. For details, the reader may be referred to the original.

C. A. KRAUS.

**On Billitzer's Method for Determining Absolute Potential Differences.** BY H. M. GOODWIN AND ROBERT B. SOSMAN. *Trans. Am. Electrochem. Soc.* 7, 83-93.—The values found by

Billitzer for absolute potentials are so much higher (0.74 volt) than those commonly accepted that the authors are led to repeat his experiments, duplicating his method as nearly as possible. The method consists in noting the deflection of a platinum ball, provided with a quartz thread suspension, when a potential gradient is applied to the liquid in which the ball is suspended. Normally the ball would be deflected either to the cathode or the anode, depending on the sign of the potential of the ball relative to the liquid. If the ball and the liquid are at the same potential, no deflection should occur and by means of an auxiliary electrode of the same metal, whose potential is the same as that of the suspended ball, it becomes possible to determine the absolute potential of various electrodes with respect to the solutions in which they are immersed. The results obtained fail to confirm the measurements of Billitzer. In addition it is stated that results obtained by Blake on the migration of colloids likewise fail to confirm Billitzer's results by the same method. The authors are inclined to attribute the discrepancies to the influence of gaseous particles on the electrode, which, as Quincke has shown, possess a negative migration.

C. A. KRAUS.

**A Low Voltage Standard Cell.** BY GEO. A. HULETT. *Trans. Am. Electrochem. Soc.* 7, 332-339.—At ordinary temperatures, it has been found that, between about 5 and 14 per cent., the electromotive force of cadmium amalgam is independent of its composition. The author therefore proposes to utilize these amalgams in the preparation of standard cells. A thin-walled glass tube of about 1 cm. diameter is provided with a small platinum electrode at the bottom and with a spiral platinum electrode several centimeters above the bottom of the tube. About 0.5 cc. of 13 per cent. cadmium amalgam is introduced into the bottom of the tube, and crystals of cadmium sulphate are added until the spiral is covered. The cell is then filled with a saturated solution of cadmium sulphate, after which it is sealed up before a blast-lamp. After making the necessary connections, the cell is placed in a second tube and covered with an insulating liquid. The cell is thus somewhat of the form of a thermometer and rapidly comes into thermal equilibrium. The cadmium electrode is formed by making the platinum spiral the cathode and depositing a quantity of cadmium (not less than 20 mg.), using a current of about 0.001 ampere. The potential of this combination is 0.05175 international volt, with a practically linear temperature coefficient of  $-0.000244$  volt per degree. At first the electromotive force is somewhat too high, becoming normal, however, after standing several weeks. Of five cells tested over a period of ten months, one exhibited a variation of only  $\pm 0.00001$  volt and the others, while not as satisfactory in their behavior, exhibited variations not exceeding 0.00005 volt.

The cell recommends itself for simplicity, and a thorough working out of the details of preparation should improve its constancy.

C. A. KRAUS.

**On the Heat of Solution of Aluminium Bromide in Ethyl Bromide.** BY HARRISON E. PATTEN. *Trans. Am. Electrochem. Soc.* **7**, 177-186.—The author has previously shown that the decomposition potential of aluminium bromide in ethyl bromide is 2.3 volts. In the present paper he communicates some results for the value of the heat of solution of aluminium bromide in ethyl bromide, with a view to computing the decomposition potential. Near 20° the following values were obtained for the heat of solution: 1.497 per cent., 23097 calories; 2.23 per cent., 20354 calories; 10.2 per cent., 17750 calories; 25.5 per cent., 11540 calories; 37.1 per cent., 7397 calories; 41.8 per cent., 6077 calories. Applying Thomson's formula and combining the heat of formation of the solid salt with the heat of solution, the calculated potential was found roughly in agreement with the experimental value. In the more dilute solutions the author considers that his results show a rapid increase of the heat of solution. From a consideration of the probable error of the experimental methods, however, it would seem that this conclusion is hardly justified.

C. A. KRAUS.

**On the Edison Storage Battery.** BY M. DEKAY THOMPSON, JR., AND H. K. RICHARDSON. *Trans. Am. Electrochem. Soc.* **7**, 95-114.—It is shown that the single potential difference of the iron electrode of the Edison battery is fairly constant at about 0.5 volt while that of the nickel electrode begins at a constant value at -0.7 volt, falls to a second constant value of about -0.2 volt, after which it approaches that of the iron electrode. The potential of -0.2 volt is ascribed to either  $\text{Ni}_2\text{O}_3$  or  $\text{NiO}$  or a mixture of the two. The capacity of the iron electrode is greater than that of the nickel electrode, but in a 6 per cent. solution the iron electrode loses its capacity. The potential of the fully charged battery on open circuit is independent of the concentration of the electrolyte. The temperature coefficient is found to depend on the concentration of the electrolyte, which is not in agreement with some previous work. By analysis of the gases evolved it is found that the efficiency of charging the iron plate is greater than that of the nickel plate in a 20 per cent. solution. The amount of material oozing from the plates increases with increasing concentration of the electrolyte.

C. A. KRAUS.

**The Rotating Diaphragm.** BY WILDER D. BANCROFT. *Trans. Am. Electrochem. Soc.* **7**, 171-176.—Some results are given on the action of a rotating diaphragm of graphite, placed in a solution of copper sulphate between copper plates. The action of the diaphragm consists essentially in the precipitation of metal on



one side and resolution of the same when the position of the diaphragm with respect to the electrodes is reversed. If both anodic and cathodic efficiencies were 100 per cent., the diaphragm would behave like a reversible metallic diaphragm. From some experiments carried out, the conclusion is reached that a rotating graphite diaphragm behaves like an ideally reversible electrode in acidulated copper sulphate solution. No visible precipitate of copper was obtained and a considerable amount of current passed through the diaphragm. C. A. KRAUS.

**Experiments with the Reduction of Different Oxides of Lead by Electric Current.** BY A. LODYGUINE. *Trans. Am. Electrochem. Soc.* 7, 221-223.—With a view to applying the process in the extraction of lead from the peroxide of lead of old storage batteries, the author carried out some experiments on the reduction of peroxide of lead. The reduction was carried out by passing a current through a mixture of peroxide of lead, sodium chloride and sulphuric acid. With power at the rate of \$15 per kilowatt year, he calculates the cost of current necessary for the reduction at 87 cents per short ton of pure lead.

C. A. KRAUS.

**Reversible and Irreversible Electrolytic Polarization.** BY W. S. FRANKLIN AND L. A. FREUNDENBERGER. *Trans. Am. Electrochem. Soc.* 7, 33-49.—The authors divide the polarization into two parts: that due to reversible, and that due to irreversible processes going on in the neighborhood of the electrodes. The first part, the "reversible" polarization, is not a function of the current although it depends on the total amount of electricity flowing, since it arises from concentration changes and allied processes which depend upon the total quantity of electricity passing. The "reversible" polarization persists on reversal of the current and contributes to the recovery of the energy previously expended. The "irreversible" polarization is a function of the current and always acts in such a manner as to oppose the current. By simultaneously measuring electromotive force and current on a cell containing copper electrodes in a solution of copper sulphate, the authors endeavor to demonstrate the "irreversible" polarization. So far as possible they eliminate "reversible" polarization although in this they are not entirely successful, owing to concentration changes induced by the current at the electrodes. Making allowance, however, for this factor they conclude that there is present in their cell an "irreversible" polarization which has a magnitude of about 0.1 volt.

C. A. KRAUS.

**An Optical Method for Observing the Diffusion in Electrolytes.** BY CARL HAMBUECHEN. *Trans. Am. Electrochem. Soc.* 7, 305-307.—In order to study the concentration currents in an electrolyte on passage of the electric current, the author con-

structs a cell of plane glass plates and places the same in the path of a projection lantern. Concentration differences not observable by the eye directly, thus become apparent. The word "diffusion" in the title is somewhat misleading.

C. A. KRAUS.

**The Aluminium Electrolytic Condenser.** BY CLARENCE IRVING ZIMMERMAN. *Trans. Am. Electrochem. Soc.* 7, 309-331. —This is a continuation of an earlier paper on the same subject. Some values are given for the electrical constants of the anode film. Thus in one instance the resistance was found to be about  $10^{11}$  ohms per cubic centimeter. The dielectric strength is placed at about  $5 \times 10^6$  volts per centimeter and the dielectric constant at 15. The unsymmetrical cell, consisting of aluminium electrodes with films of different electrostatic capacities, is discussed and analyzed. It is shown that the unidirectional pressures across each electrode may be considerably greater than the impressed pressure. The "equivalent" capacity is  $\frac{C_1 C_2}{C_1 + C_2}$ , where  $C_1$  and  $C_2$  are the capacities of the films on the two electrodes. Finally, polyphase condensers are discussed and the corresponding equations are given for the aluminium and the tin foil condenser.

C. A. KRAUS.

**An Electrolytic Switch.** BY WILLIAM SMITH HORRY. *Trans. Am. Electrochem. Soc.* 7, 237-241. —A switch is described in which an aluminium cell is employed to avoid the spark which occurs under ordinary conditions. The plate surface necessary under given conditions is discussed.

C. A. KRAUS.

**The Mercury Arc.** BY E. WEINTRAUB. *Trans. Am. Electrochem. Soc.* 7, 273-289. —The author describes various types of mercury arcs as well as rectifiers, discussing the difficulties that have been overcome in perfecting them and the principles underlying their action. The vapors of the alkali metals behave like mercury as regards the arc. This topic, however, is treated very briefly. As regards the purely physical aspects of the problem the author concludes that either a transfer of matter does not accompany the current in the mercury arc or the mass associated with the charge is of the order of magnitude of that of the electrons. The current-bearing material is formed at the cathode and the ionization is not due to the temperature but rather to causes of an electrical nature.

C. A. KRAUS.

**Arcs.** BY W. R. WHITNEY. *Trans. Am. Electrochem. Soc.* 7, 291-299. —In this paper are discussed various problems in connection with arcs, particularly the loss of electrode material accompanying the passage of the current. Numerous experiments are cited from which the general conclusion is drawn

that no necessary relation exists between the loss of electrode materials and the current passing through the arc.

C. A. KRAUS.

**The Electrostatic Treatment of Ore.** BY LUCIEN I. BLAKE. *Trans. Am. Electrochem. Soc.* 7, 211-218.—The author describes an electrostatic ore separator. In principle the method consists in charging the finely crushed ore by bringing it in contact with a charged metal roll. The metal particles after charging are repelled and on falling from the charged cylinder a partial separation is effected from the uncharged particles which are not repelled. This process is repeated a number of times, only the two extreme portions leaving the separator, while the middle portions again pass through the machine. The details of the process vary considerably with the nature of the ore to be treated.

C. A. KRAUS.

**Franklin as a Man of Science and an Inventor.** BY EDWIN J. HOUSTON. *J. Franklin Inst.* 161, 241-316 and 321-385; portraits, figures.—In this lengthy address, delivered on February 21, 1906, are set forth in a clear and entertaining manner the claims of Franklin to "be regarded as the most distinguished man of science that this country has ever produced." Copious extracts of his scientific correspondence and writings are given, followed by comments and explanations. The tremendous industry, great versatility and clear and logical reasoning of Franklin are strongly set forth, as well as the utilitarian trend of his thoughts and aims, these last being apparent in his writings and attested by his numerous and practical inventions.

W. F. HILLEBRAND.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Bibliography of Canadian Geology and Palaeontology for the Year 1903.** BY H. M. AME. *Trans. Roy. Soc. Canada*, 10, Part I, Section iv, pp. 207-219. **Bibliography of Canadian Geology and Palaeontology for the Year 1904.** BY H. M. AMI. *Ibid.* 11, Section iv, pp. 127-142.

W. F. HILLEBRAND.

**The Chemical Industries of the Dominion [Canada].** BY W. R. LANG. *Trans. Canadian Inst.* 7, 151-190.—This is an "entire revisal," brought down to April 1905, of a paper that appeared in the *J. Chem. Ind.* May 15, 1903.

W. F. HILLEBRAND.

**Ann. Rep. Minister of Mines [British Columbia] for the Year 1905.** 273 pp.; map, plates.—The chemical matter of this report is confined to a few soil and proximate analyses of coals.

W. F. HILLEBRAND.



**An Examination of Some Canadian Micas.** By J. E. EGLESON. *Trans. Roy. Soc. Canada*, 10, Part I, Section iii, pp. 57-61.—Detailed analyses of six micas from the following localities are given: (1) Muscovite, Villeneuve mica mine, Ottawa County, Quebec; (2) Muscovite, Brassard Township, Berthier County, Quebec; (3) Biotite, Sebastopol (range X, lot 31), Renfrew County, Ontario; (4) Biotite, McFarlane apatite mine, Wakefield, Ottawa County, Quebec; (5) Phlogopite, Adams mine, Portland Township, Ottawa County, Quebec; (6) Lepidomelane, Monmouth Township (range IX, lot 16), Ontario.

	1.	2.	3.	4.	5.	6.
SiO <sub>2</sub> .....	44.12	44.44	39.16	39.18	39.94	31.48
TiO <sub>2</sub> .....	0.21	0.23	0.56	0.26	0.16	0.09
Al <sub>2</sub> O <sub>3</sub> .....	35.74	33.58	27.50	13.29	17.80	19.64
Fe <sub>2</sub> O <sub>3</sub> .....	3.65	5.64	3.04	5.50	1.05	5.85
FeO.....	0.89	1.07	12.89	3.93	0.67	27.96
MnO.....	0.38	0.16	0.54	0.40	0.08	1.61
CaO.....	0.64	0.86	0.22	0.00	0.00	1.33
MgO.....	1.59	3.53	4.66	25.08	27.88	2.99
K <sub>2</sub> O.....	7.89	7.77	6.89	7.76	9.13	4.17
Na <sub>2</sub> O.....	2.08	1.01	1.01	0.96	0.35	1.68
Li <sub>2</sub> O.....	0.12	0.00	0.00	trace	0.00	0.00
H <sub>2</sub> O (comb.).....	2.88	2.04	1.59	1.83	2.13	3.94
Fl.....	0.20	0.46	3.03	2.84	0.86	0.00
	100.39	100.79	101.09	101.03	100.05	100.74
Less O for Fl.....	0.08	0.19	1.27	1.18	0.36	0.00
	100.31	100.60	99.82	99.85	99.69	100.74
Sp. gr.....	2.84	2.88	3.03	2.95	2.76	3.25

Nos. 1 and 2 are true ortho-silicates, the others are more basic.

W. F. HILLEBRAND.

**The Shelburne Meteorite.** By O. C. FARRINGTON. *Pub. Field Columbian Mus., Geol. Series*, 3, No. 2, pp. 7-17; plates.—The smaller of the two fragments found is described without analysis (for description of the larger see this Journal, 27, R 456). In most respects the author's observations are confirmatory of Borgström's, made on the larger fragment of 3.499 specific gravity. That of the smaller is 3.504 and the calculated porosity 6.3.

W. F. HILLEBRAND.

**The South Bend Meteorite.** By O. C. FARRINGTON. *Pub. Field Columbian Mus., Geol. Series*, 3, No. 2, pp. 19-23; plates.—This pallasite, the first of the Imilac group to be found in the United States, weighed 2,374 grams when found in 1893, two miles southeast of South Bend, St. Joseph County, Indiana. The surface is deeply pitted with confluent cavities, which were doubtless formerly occupied by chrysolite. The specific gravity is 4.28, from which and assumed densities for the constituents the approximate percentages of chrysolite and nickel-iron are calculated as 78.63 and 21.37 respectively. Etch figures show that the nickel-iron has the common composition, kamacite,

taenite and plessite. Analysis of it afforded W. H. Nichols: Fe, 90.22; Ni, 9.35; Co, 0.26; Cu, 0.11; P, 0.05; S, 0.05; total, 100.04. Schreibersite is an accessory constituent. It is noteworthy that the positions of fall of five of the six known meteorites from Indiana and the three from Michigan follow closely the meridian of  $86^{\circ}$ .

W. F. HILLEBRAND.

**Clays, Limestones and Cements.** BY G. P. GRIMSLEY. *West Virginia Geol. Survey*, 3, xviii+565 pp.; plates, figures.—This is a valuable addition to the growing list of publications dealing with the economic resources of our States taken singly. Over half the report is devoted to the clays, of which there are many analyses and results of physical tests by F. F. Grout. The latter contributes also a section on his method of determining plasticity, which in large part appeared earlier in the pages of this Journal (27, 1037). Much space is given to chapters on the properties, classification, technology, etc., of the several materials named in the title.

W. F. HILLEBRAND.

**Hypothesis to Account for the Transformation of Vegetable Matter into the Different Grades of Coal.** BY A. C. LANE. *Economic Geol.* 1, 498-499.—From perusal of the recent paper by M. R. Campbell, bearing the above title (this Journal, 28, R 4), the author is led to inquire as to the possible effects of the former great mantling ice-sheet north of the Ohio in checking the rate of alteration toward anthracite of the underlying coals. He suggests other factors that may have had a bearing on the character and extent of the alteration of coals generally, such as the varying composition of the vegetation that formed the beds in different geological ages, and the influence of the varying composition of the waters in which the beds were laid down and of the surface waters that may have later gained access through joints.

W. F. HILLEBRAND.

**Prowersose (Syenitic Lamprophyre) from Two Buttes, Colorado.** BY WHITMAN CROSS. *J. Geol.* 14, 165-172.—This rock, derived from the larger of two laccoliths, is of unusual mineral composition and is, moreover, texturally very different from the prowersose of the next abstract. It illustrates "the fact, not yet sufficiently recognized among petrographers, that there may be important variations in the mode or actual mineral composition of igneous rocks possessing very similar chemical composition." It is fine-grained, greenish gray, with a habit sometimes exhibited by minette. Brown biotite is its most prominent constituent, accompanied by much pale green augite and an abundance of interstitial orthoclase feldspar and minute magnetite grains, the larger biotite crystals being the most prominent megascopic components. The pyroxene is a strongly diopsidic augite, having the composition (Hillebrand):  $\text{SiO}_2$ ,

51.27;  $\text{Al}_2\text{O}_3$ , 3.05;  $\text{Fe}_2\text{O}_3$ , 3.08;  $\text{FeO}$ , 4.34;  $\text{MgO}$ , 14.21;  $\text{CaO}$ , 22.58;  $\text{Na}_2\text{O}$ , 0.67;  $\text{K}_2\text{O}$ , 0.06;  $\text{TiO}_2$ , 0.70;  $\text{NiO}$ , 0.03;  $\text{MnO}$ , 0.28;  $\text{BaO}$ ,  $\text{SrO}$ , none; total, 100.27; sp. gr., 3.45. The analysis of the rock as a whole is (Hillebrand):  $\text{SiO}_2$ , 50.41;  $\text{Al}_2\text{O}_3$ , 12.27;  $\text{Fe}_2\text{O}_3$ , 5.71;  $\text{FeO}$ , 3.06;  $\text{MgO}$ , 8.69;  $\text{CaO}$ , 7.08;  $\text{Na}_2\text{O}$ , 0.97;  $\text{K}_2\text{O}$ , 7.53;  $\text{H}_2\text{O}$ —, 0.46;  $\text{H}_2\text{O}$ +, 1.80;  $\text{TiO}_2$ , 1.47;  $\text{P}_2\text{O}_5$ , 0.46;  $\text{V}_2\text{O}_5$ , 0.03;  $\text{NiO}$ , 0.04;  $\text{MnO}$ , 0.15;  $\text{BaO}$ , 0.23;  $\text{SrO}$ , 0.06; total, 100.42. The relationships are discussed.

W. F. HILLEBRAND.

**Some Unusual Rocks from Maine.** BY EDSON S. BASTIN.

*J. Geol.* **14**, 173–187; figures.—*I. Prowersose from Knox County.* Concerning this second observed occurrence of prowersose the author says: “The commonest phase is massive and shows numerous purplish-gray phenocrysts of feldspar in a rather fine, dark-green, even-grained matrix made up almost entirely of biotite and green hornblende” (see previous abstract). Other minerals are titanite, titaniferous magnetite, apatite and quartz. The composition (G. Steiger) is:  $\text{SiO}_2$ , 52.26;  $\text{Al}_2\text{O}_3$ , 10.63;  $\text{Fe}_2\text{O}_3$ , 2.47;  $\text{FeO}$ , 5.45;  $\text{MgO}$ , 9.32;  $\text{CaO}$ , 5.62;  $\text{Na}_2\text{O}$ , 1.60;  $\text{K}_2\text{O}$ , 5.99;  $\text{H}_2\text{O}$ —, 0.98;  $\text{H}_2\text{O}$ +, 1.97;  $\text{TiO}_2$ , 1.92;  $\text{P}_2\text{O}_5$ , 0.98;  $\text{MnO}$ , 0.12;  $\text{ZrO}_2$ , 0.08;  $\text{CO}_2$ , 0.75; total, 100.14. *II. Albite-pyroxene-syenite.* Forms part of a series of greenstones distributed over a large island area in Penobscot Bay. This and the following rocks are described in some detail, but without analytical data. *III. A new occurrence of cortlandite.* Found in a single outcrop near Penobscot in Hancock County. *IV. Porphyritic granite from Somerset County.*

W. F. HILLEBRAND.

**The Hot Springs at Thermopolis, Wyoming.** BY N. H.

DARTON. *J. Geol.* **14**, 194–200; figures.—“At the southern end of the Bighorn Basin there is a great hot spring which presents some notable geologic features and an interesting question as to the source of the hot water.” No conclusion is reached on this last point. Besides the large spring there are several others, all issuing from the Red Beds, and they have built extensive terraces of travertine. The water is clear and has a temperature of  $135^\circ\text{F}$ . “Numerous algae of various colors grow in the hot and cooling water.” The composition of the solid constituents of the water from the great spring is, in grains per gallon, according to E. E. Slosson:  $\text{SiO}_2$ , 4.986;  $\text{Fe}_2\text{O}_3$  and  $\text{Al}_2\text{O}_3$ , 0.227;  $\text{KCl}$ , 10.249;  $\text{Na}_2\text{SO}_4$ , 15.110;  $\text{MgSO}_4$ , 19.443;  $\text{CaSO}_4$ , 13.156;  $\text{CaCO}_3$ , 40.454;  $\text{NaCl}$ , 26.195; total, 129.820.

W. F. HILLEBRAND.

**Volcanoes and Radioactivity.** BY C. E. DUTTON. Private

reprint from the *Englewood (New Jersey) Times*, 12 pp. later in *J. Geol.*, **14**, 259–268.—In this paper, read before the National Academy of Sciences, in Washington, D. C., April 17, 1906, the author presents arguments in favor of the following probable cause of volcanic eruptions: “They are caused, I conceive, by a develop-



ment of heat resulting from radioactivity in limited tracts at a depth of one to three—at the very utmost, not over four miles from the surface, which is sometimes sufficient to melt the rocks affected by it. The melting is gradual, and when a sufficient quantity is melted, the water which it contains becomes explosive and usually suffices to break through the covering, constituting an eruption. When all the lava is erupted and the reservoir is exhausted, it closes up for a time. If the heat continues to be generated, more lava is melted, and in due time another eruption occurs.” The process may be repeated hundreds, even thousands of times. Inability to break through the covering may result in intrusive or abortive eruptions. “All volcanic lavas contain water and those whose reservoirs are near the surface contain a large amount of it. Those which have a deeper origin contain a smaller amount of it. The deeper lavas are hotter, are erupted with less violence and in greater mass than the shallow ones, and the reason is obvious.”

W. F. HILLEBRAND.

**The Chemical Evolution of the Ocean.** BY ALFRED C. LANE. *J. Geol.* **14**, 221–225.—An abstract of a paper read at the Ottawa meeting of the Geological Society of America, December, 1905, the subject having been suggested by the chemical character of the deeper mineral waters of Keweenaw Point, Upper Michigan, of which some analyses are given. The paper is not well adapted to the preparation of a brief and clear abstract.

W. F. HILLEBRAND.

**The Iron Concretions of the Redbank Sands.** BY O. W. WILLCOX. *J. Geol.* **14**, 243–252; figures.—These remarkable forms occur in great numbers in the loose quartzose Redbank sands of Monmouth County, which are generally colored red by iron oxide derived from original glauconite. The primary type is a very long, more or less regular, hollow cylinder. They all occupy a horizontal position and lie with their longer axes parallel to the strike of the formation. The cementing material is iron oxide, by the concentration of which the adjacent portions of the sands have become more or less bleached. No explanation offers itself as to the cause that produced these singular forms, but the author regards as clear the evidence that the transportation of the cementing material was by molecular diffusion and not convection.

W. F. HILLEBRAND.

**The Underflow in Arkansas Valley in Western Kansas.** BY CHARLES S. SLICHTER. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 153*, 90 pp.; plates, figures. **Underground Water in the Valleys of Utah Lake and Jordan River, Utah.** BY G. B. RICHARDSON. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 157*, 81 pp.; maps, plates, figures.—In the

first of these reports the chemical data comprise field tests of the underground waters, and in the second analyses, gathered from various sources and reduced to common terms, of water from streams, springs and wells.

W. F. HILLEBRAND.

**Geology and Coal Resources of the Cape Lisburne Region, Alaska.** BY A. J. COLLIER. *U. S. Geol. Survey, Bull. 278*, 54 pp.; maps, plates, figures.—It has been demonstrated that the coal fields are much more extensive than was generally supposed and that there are two distinct coal-bearing formations, one lying east of Cape Lisburne and carrying low-grade bituminous coal of Jurassic age, the other lying south of the cape and carrying high-grade bituminous coal of lower carboniferous age. Analyses of these coals by chemists of the survey are given.

W. F. HILLEBRAND.

**The Rampart Gold Placer Region, Alaska.** BY L. M. PRINDLE AND F. L. HESS. *U. S. Geol. Survey, Bull. 280*, 54 pp.; plates, figure.

W. F. HILLEBRAND.

**Oil Fields of the Texas-Louisiana Gulf Coastal Plain.** BY N. M. FENNIMAN. *U. S. Geol. Survey, Bull. 282*, 146 pp.; maps, plates, figures.—This report embodies the results of examinations made since the earlier survey, Bulletin 212, by Hayes and Kennedy, in 1903. No new chemical data seem to be given except two analyses of mineral waters from springs at High Island.

W. F. HILLEBRAND.

**Report on the Petrography of the Cuyuni and Mazaruni Districts, and of Rocks at Omai, Essequibo River, with Some Notes on the Geology of Part of the Berbice River [British Guiana].** BY J. B. HARRISON. *Publication Science and Agric. Dept. Georgetown, Demerara*, 71 pp.—This is the last of a series of reports, commenced in 1897, on the geology of the gold-bearing districts of British Guiana. Rocks in great number and variety are described, and, where analyzed, they have received names in accordance with the quantitative classification. A noteworthy feature of the report is the large number of detailed analyses and the showing which they make as to the minor constituents among the heavy metals. Copper is pretty generally present in both basic and acidic rocks in amounts measured by hundredths of a per cent. Lead is frequently present in smaller amount. Gold is present in all the rocks of the district and silver in most. The basic rocks are on the whole but little richer in gold than the acidic rocks. Field observations, however, indicate that amphibolite and hornblende schist are the main sources of the metal in the Groete creek, Cuyuni and Puruni districts. These rocks are metamorphosed gabbro or diabase and in them the gold occurs both as a constituent of the heavy minerals and as free gold in the

numerous veins and veinlets of quartz which traverse them. The basic rocks form laterite soils, the matrix of much of the "so-called alluvial" gold. The heavier minerals of the basic rocks give rise, on decomposition of the rocks, to black sands consisting chiefly of ilmenite. Though free from visible gold one of these sands yielded 118 grains gold and 150 grains silver to the ton of 2240 pounds. An appendix contains a list of several hundred rocks, with names, localities and specific gravities.

W. F. HILLEBRAND.

**Sketch of the Geology and Ore-Deposits of the Cherry Creek District, Arizona.** BY JOHN A. REED. *Economic Geology*, 1, 417-436.—The mines are worked at present for gold, which is found with limonite in quartz veins within porphyry dikes. Just below the outcrop is a zone of impoverishment; assay values are notably less five or ten feet down than at the surface, even iron oxides and silica having been largely removed. Lower is the rich oxidized ore, limonite with a little pyrite, and below this chalcopryite and bornite increase to a rich secondary sulphide ore. Carbonates and oxides of copper as well as chalcocite and covellite are entirely absent; this peculiarity is attributed to the presence of abundant ferric salts and sulphuric acid, free oxidation by vadose waters having been possible owing to the fractured condition of the rock. "With depth it is almost beyond doubt that the gold values will decrease while the copper will increase in amount."

E. C. SULLIVAN.

**The Formation of Asphalt Veins.** BY GEORGE HOMANS ELDRIDGE. *Economic Geology*, 1, 437-444.—Veins of asphalt are of far wider distribution than those of metalliferous materials. There is no marked difference in the vein phenomena in the two cases. The character and value of an asphalt vein depend largely on the nature of the country rock; those in the more heavy-bedded rocks are more regular and those in thinly-laminated shales are often extremely irregular. There is little doubt that the asphalt is derived from petroleum and introduced from original deposits in the neighboring strata or from rock reservoirs into the fissures in which it is found.

E. C. SULLIVAN.

**Copper Deposits of the Eastern Townships of Quebec.** BY JOHN ALEXANDER DRESSER. *Economic Geology*, 1, 445-453.—The deposits are of three classes, the first, with which this paper deals, including all the ore bodies at present exploited. These contain chalcopryite with small quantities of chalcocite and less of carbonates and pyrite, and occur in lenticular masses in porphyry-andesite schists. The gangue when distinct from the country rock is quartz, sometimes calcite. The metals were primarily brought in with the igneous rock and subsequently leached out and redeposited by replacement. In evidence of



secondary enrichment there appears to be a slightly higher copper and distinctly greater gold value near the surface. A second class of deposits consisting of chalcopyrite, bornite and chalcocite with small amounts of carbonates forms irregular bodies in sediments where these are intruded by dikes. The gangue is largely calcite. Chalcopyrite in pyrrhotite, with a little pyrite, forms the third class, situated along the contact of an intrusive diabase with an iron-bearing slate or other metamorphic rock.

E. C. SULLIVAN.

**On the Origin and Relations of the Nickel and Copper Deposits of Sudbury, Ontario, Canada.** BY ALFRED ERNEST BARLOW. *Economic Geology*, I, 454-466.—After a historical resumé of the literature on these deposits the author gives a petrographic description of the nickel-bearing eruptive, with a basic portion of which the sulphides are associated. "The sulphides are distinctly of primary origin, and were among the earliest of the minerals to crystallize from the original magma." These sulphides frequently occur in portions of the norite which scarcely have felt dynamic metamorphism and which "have been so little affected by hydrochemical agencies that such readily alterable minerals as hypersthene, enstatite, olivine, and diallage are still plainly recognizable."

E. C. SULLIVAN.

**Notes on the Origin of the Sudbury Ores.** BY DAVID H. BROWNE. *Economic Geology*, I, 467-475.—As arguing for the magmatic theory the author cites the absence of indications of leaching or of secondary mineralization. "In a pot of molten matte the copper tends to move outward toward the cooling sides, while nickel is concentrated inward toward the center," and the ore shows a segregation, apparently similar, of copper outwards toward the rock and of nickel inwards toward the center or at least toward the hottest part of the deposit. The author considers it unlikely that the difference in composition between the gangue and the surrounding rock was brought about by waters carrying the sulphides. He prefers to think that as the most basic portion of a magma the gangue solidified last and that the sulphides were segregated with it. The brecciated fragments enclosed in the ore bodies and the neighboring rocks point to a common origin of both.

E. C. SULLIVAN.

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## ANALYTICAL CHEMISTRY.

**An Electrical Method for the Simultaneous Determination of Hydrogen, Carbon and Sulphur in Organic Compounds.**

BY H. N. MORSE AND C. W. GRAY. *Am. Ch. J.* 35, 451 (1906).—A modification of the apparatus described by Morse and Taylor (see this Review 33, 591 (1905)). The three modifications introduced are briefly as follows: (1) The coils of wire at the end of the

porcelain tube nearest the stopper are wound tightly about the tube for one-half its length. This permits the introduction of a boat containing a weighed quantity of lead dioxide to absorb the oxides of sulphur. The rear end of the boat is open to facilitate contact between the products of combustion and the peroxide. (2) The rolls of copper oxide used in the first apparatus are replaced by asbestos plugs. (3) An accessory apparatus for the absorption of the oxides of nitrogen is employed. This apparatus consists of a glass tube about 300 mm. in length, filled with asbestos mixed with lead peroxide. The glass tube is surrounded by a graphited porcelain tube, which is electrically heated. The apparatus is enclosed in an asbestos covering. The analytical procedure follows: After closing the circuits the absorption chain is attached to the thoroughly dried apparatus, and oxygen is admitted through the porcelain tube by means of a T-tube. The substance in the boat is heated by a Bunsen burner held in the hand. At the completion of the analysis, the material in the dioxide boat consists of lead dioxide, lead sulphate, and if the substance contained nitrogen, lead nitrate. The lead dioxide is first dehydrated at  $300^{\circ}\text{C}$ ., due care being taken in the weighing to prevent absorption of moisture. Then the amount of  $\text{PbO}$  yielded by a known weight of the dioxide is carefully determined by heating to constant weight in a current of nitrogen. It is now necessary only to reduce the lead nitrate and lead dioxide, weigh the residue and determine the amount of sulphur. This is calculated as  $\text{SO}_3$ . The reduction is effected by placing the boat and its contents in a hard glass tube. Behind it is inserted a roll of copper gauze, and both roll and boat are heated in a current of air or nitrogen. Carbon and hydrogen are of course collected and weighed in the absorption apparatus as  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .

H. G. BURNHAM.

**The Determination of the Feldspars by Means of Their Refractive Indices.** BY F. E. WRIGHT. *Am. J. Sci.* [4] 21, 361.—

The method of determination of the refractive indices depends upon the phenomena occurring when a small fragment of the mineral is immersed in a liquid between the slide and a cover glass and observed under the microscope with half darkened field. If the mineral have an index higher than that of the liquid its edge next the shadow appears brighter than the edge opposite but if the mineral have the lower index its edge next the shadow appears darker. If the mineral and the liquid have equal indices the opposite edges of the grain appear colored red and blue. A set of standard liquids with indices varying between that of orthoclase and that of anorthite can be made up from mixtures of oil of cedar, oil of cloves and oil of cinnamon and the feldspar can be quickly determined by comparison with the liquids of known index. An accuracy of five in the third place of decimals is claimed for this method.

L. F. HAWLEY.

## AGRICULTURAL CHEMISTRY.

**Some Peculiarities of Rock-Weathering and Soil Formation in the Arid and Humid Regions.** By E. W. HILGARD. *Am. J. Science*, April, 1906.—Weathering in the absence of moisture produces but little clay. In humid regions the proportion of clay formed is much greater and the frequent rains carry this into the lower depths, forming a clay subsoil. The texture of the latter is close and limits the feeding range of the plant roots. In arid regions, on the other hand, there are no rains to carry the smaller amounts of clay into the lower depths, consequently there exists a soil made up of coarser particles, formed in large part by the sudden and extreme changes in temperature, into which plant roots can penetrate to a much greater depth. In the absence of rainfall leaching does not take place in arid regions, and the average of a large number of analyses of soils from these areas shows a larger amount of soluble mineral plant food than in humid soils. Of nitrogen and humus, however, there is much less in arid than in humid soils. In arid regions the leaves and plant residues dry up, oxidize, and disappear. But plant growth does not suffer on account of this condition because the soil is so open that it does not need the organic matter to improve its physical condition and the larger feeding range counterbalances the lower percentage of nitrogen. J. H. PETTIT.

**Fertility Studies on Strongsville Soil.** By the Bureau of Soils, *U. S. Dept. Agr. Bull. 168, Ohio Agr. Expt. Sta.*—An attempt is made to show that the wire basket method of studying soils will give indications in line with results obtained in the field during a period of nine years. This method showed that the use of either nitrogen, phosphorus or potassium on the soil increased the yield in but few cases, but that various forms of lime, farm manure, and green manures did increase the yield. These latter materials are all thought to improve the physical condition of the soil, which is the important factor at Strongsville. The effect of lime is thought to result from its action upon the physical condition, and not upon the acidity of the soil, because about one ton of either sodium carbonate or sodium hydroxide per acre did not increase the yield. So far as the use of plant food is concerned, the results are not in line with the published field results, but the authors state that the investigations must be considered as merely preliminary as the experiments were conducted under unfavorable conditions. J. H. PETTIT.

**Fertility Studies on Wooster Soil.** By the Bureau of Soils, *U. S. Dept. Agr. Bull. 167, Ohio Agr. Expt. Sta.*—Like the above this is another attempt to show that the growing of seedlings for twenty days will give indications as to the requirements of the soil which are in line with extensive field work. Such a position



is scarcely tenable from the data published when studied in connection with the field results already published.

J. H. PETTIT.

**The Wire Basket Method for Determining the Manurial Requirements of Soils.** BY FRANK D. GARDNER. *Circ. No. 18, Bur. Soils, U. S. Dept. Agr.*—The method devised by the Bureau is described in detail. In conclusion the author states—"it should be borne in mind that this is a method not for the study of the requirements of plants, but for the fertilizer requirements of soils, in which the plants are used as an indicator."

J. H. PETTIT.

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### PHARMACEUTICAL CHEMISTRY.

**Liquor Cresolis Compositus.** BY CHARLES LA WALL AND E. FULLERTON COOK. *Am. J. Pharm.* **78**, 169 (1906).—The writers have examined several samples of cresol including those of English, German and American manufacture. They find that most of the samples agree very closely with the pharmacopoeial requirements, as to boiling-point, but nearly all had a lower specific gravity, and about half were less soluble than the pharmacopoeial standard. This variation may be due to the varying proportions of the three isomers. They found that solutions prepared according to official directions did not become entirely soluble until they had stood nineteen days. The authors prepared solutions that were soluble at once, by the following method: Heat the 350 grams of linseed oil in a capacious vessel, on a water-bath, to about 70°. Dissolve 80 grams of potassium hydroxide in 450 cc. of water, warm to 70° and add it to the linseed oil and mix thoroughly. Then incorporate 40 cc. of alcohol and continue the heating, without stirring, until a small portion of the mixture is found to be soluble in boiling water without the separation of oily drops. The soap thus prepared is now dissolved in 500 grams of cresol and a sufficient quantity of water added to make the solution weigh 1000 grams.

A. B. STEVENS.

**Sale of Narcotics and of Proprietary Medicines Containing Alcohol.** *Am. J. Pharm.* **78**, 145 (1906).—At a conference of delegates from the American Pharmaceutical Association, Proprietary Association of America, National Association of Retail Druggists and National Wholesale Druggists' Association, drafts on two bills were prepared. The first is intended "To provide against the evils resulting from the traffic in certain narcotic drugs, and to regulate the sale thereof." The bill includes such drugs as opium, morphine, heroine, cocaine,  $\alpha$ - and  $\beta$ -eucaine, chloral hydrate or any preparations containing them, except on a written order of an authorized practitioner of medicine, dentistry or veterinary medicine. The order is to be retained by the dis-

penser without giving a copy, and such order is not to be again compounded, except on the written order of the prescriber. It also makes it unlawful for the above practitioners to give an order for such preparations to an habitual user of them unless such person is under treatment by the prescribers in the regular practice of their profession. It makes it unlawful for any veterinary practitioner to prescribe any of the foregoing drugs for any human being. The proposed law does not apply to preparations containing not more than two grains of opium, or one-fourth grain of morphine, or one-fourth grain of heroine, or one-eighth grain of cocaine, or one-eighth grain of  $\alpha$ - or  $\beta$ -eucaine, or ten grains of chloral hydrate to one fluid or avoirdupois ounce. The second bill is intended "To regulate the sale of certain proprietary medicines." All proprietary medicines which contain more alcohol than is necessary for the extraction of the drug, or for the preservation of the preparation, are to be considered as intoxicating liquors and shall be subject to the same regulations.

A. B. STEVENS.

**Progress in Pharmacy.** BY M. J. WILBERT. *Am. J. Pharm.* 78, 129 (1906).—The first part of the article is devoted to the warfare on nostrums and fraudulent preparations. The author states that the bill pending in New York requires that proprietary medicines containing alcohol, or any hypnotic, anesthetic, analgesic, or cardiac, circulatory, respiratory or nerve depressant shall be plainly labeled with a true statement of the percentage of alcohol, and the proportion of active drugs that would come under any of these special headings. The bill provides for analyses of suspected preparations, and also penalties for violation of the law. The formula bill proposed by Bok, in the *Ladies' Home Journal*, requires that the label on all proprietary medicines shall give a list of all ingredients with their exact proportions. The author calls attention to the work of the Council on Pharmacy and Chemistry of the American Medical Association, and states that quite a number of local societies have endorsed the work outlined by the Council and have requested individual members to favor publicity and honesty in all that pertains to medicine. The stockholders of *American Medicine* have directed its managers to adopt a standard for advertising, as high as that of the *J. Am. Med. Ass.* The author refers to the methods adopted to familiarize physicians with the pharmacopoeia, such as a series of articles in the *J. Am. Med. Ass.* on "The Physician and the Pharmacopoeia." Also addresses before medical societies upon the pharmacopoeia. The author notes the publication of a new edition of the Spanish Pharmacopoeia which gives a minimum alkaloidal standard for a number of drugs without giving methods for assay. In like manner a high standard of purity is required for many chemicals, but no method for determining the purity

is given. The Austrian Pharmacopoeia became official July first. The International standard for patent remedies has practically been adopted. The atomic and molecular weights are based on  $O = 16$ . This is also true of the Spanish edition. *Acetanilide in Bromo-Seltzer*.—According to the *J. Am. Med. Ass.*, this preparation contains potassium bromide 10.53 parts, acetanilide 4.58 parts, caffeine 1.2 parts. The following are from abstracts by the author, from *Apoth. Ztg.* (1905). *Alco* is an amorphous powder consisting of basic aluminum carbonate. It is used as a local disinfectant and astringent.

*Histosan* is a slightly aromatic, light brown powder, said to be a combination of albumin and guaiacol. Recommended in tuberculosis, and in diarrhoea.

*Proponal* is a white crystalline substance, said to be more active than veronal, given in doses of from 0.15 to 0.5 gram. It is said to be dipropylbarbituric acid.

*Santyl* is a light yellow oily liquid, insoluble in water but soluble in alcohol or ether. It is said to be a salicylic acid ester of sananol.

A. B. STEVENS.

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## PATENTS.

NOVEMBER 28, 1905.

806,046-7. Ralph Baggaley, Pittsburg, Pa. **Smelting and converting copper ores.** A relatively large mass of raw ore is placed in a vessel and sealed into position opposite the two tuyeres and thereto is added a relatively small quantity of molten matte high in fuel value, and subjected to air blast.

806,053. Rene Bohn, Mannheim, Germany. Assignor to Badische Anilin & Soda Fabrik, Ludwigshafen-on-Rhine. **Naphthalene dye.** The dye is produced by heating naphthazarine in aqueous solution with more than two molecular proportions of caustic soda, and treating the product with sodium bisulphite. The bisulphite form of the compound is more easily soluble in water and can be recrystallized from benzene, and thus obtained in red needles which are soluble in sulphuric acid with a fuchsin-red color, and in nitrobenzene with an orange-red color; it dyes wool from an acetic acid bath orange-red shades which upon treatment with a bichromate are converted into reddish-black shades.

806,060. Cornelius A. Burns and Cornelius E. Raab, Pittsburg, Pa. **Compound for hardening iron.** Chloride of sodium 3, saltpeter 3, rock-alum 3, carbonate of ammonium 3, salts of tartar 3, yellow prussiate of potassium 1, white cyanide of potassium 1, and red prussiate of potassium 1 part.

806,077. Ernest Fussenegger, Ludwigshafen-on-Rhine. Assignor to Badische Anilin & Soda Fabrik, same place. **Azo coloring-matter.** A coloring-matter which can be obtained by



combining diazotized sulphanilic acid with 1,3-dihydroxyquinoline; it dyes unmordanted wool yellow shades, in the form of its lakes possesses yellow shades, and upon reduction with tin and hydrochloric acid yields sulphanilic acid and aminodihydroxyquinoline.

DECEMBER 5, 1905.

806,131. George W. Gentieu and Robert S. Waddell, Peoria, Ill. **Smokeless powder.** Nitrocellulose is agitated by jets of compressed air till broken up into porous grains which are saturated and rendered colloid by a solvent forced into them by compressed air, the agitation being continued, and the air finally somewhat heated to remove the solvent and dry the grains.

806,146. Edward H. Hurry, Bethlehem, and Harry J. Seaman, Catasauqua, Pa. **Portland cement.** Carbonate of lime is first calcined to drive off carbon dioxide, then mixed with argillaceous matter containing silica and alumina and also with coal or coke, sustaining the combustion by an air-blast under pressure, thereby melting the cement, which is drawn off, cooled and ground.

806,153. Walter J. Kohler, Sheboygan, Wis. Assignor to J. M. Kohler Sons Company, same place. **Speckled enamel ware.** A small amount of powdered carborundum is mixed with powdered enamel of a different color and which is more fusible than the carborundum, the article is coated and the mixture fused at a heat sufficient to melt the enamel but not hot enough to melt the carborundum.

806,194. Mentheim Salomon, Toledo, Ohio. Assignor to Edward A. Dewey, same place. **Fuel.** Powdered coal 2000, pitch 35, glue 5, and sugar 2.

806,392. Becher B. Bolton, Wilmington, Cal. Assignor to Henry E. Hazard and George E. Harpham, Los Angeles, Cal. **Photometer.** An opaque tube having between the ends thereof a semitransparent test scale with characters thereon graduated to be gradually discernible as the intensity of the light increases.

806,415. Thilo Kroeber, Basel, Switzerland. Assignor to the firm of Chemical Industry, same place. **Blue azo dye.** 1-2-Aminonaphtholsulphonic acids are acidylized in the hydroxyl group, then diazotized and combined with naphtholsulphonic acids. The product dissolves blue in water and in concentrated sulphuric acids, and dyes unmordanted wool in bordeaux shades, becoming blue on treatment with chromium compounds.

806,467. Walter Feld, Honingen-on-Rhine, Germany. **Recovering ammonia and hydrocyanic acid.** Gases containing ammonia and cyanogen are treated with a ferrous compound and acid alkaline or earth alkali salts as calcium chloride, whereby the iron unites with the cyanogen and the acid reacts with the ammonia,

making ammonium chloride, then distilling off the sludge to recover ammonia and precipitating the iron cyanogen salt.

806,533. Max Fremery, Oberbruch and Emile Bronnert, Mühlhausen, Nieder-Morschweiler, Germany and Johann Urban, St. Polten, Austria-Hungary. **Cellulose films.** Threads of cuprammonium cellulose are injected into sulphuric acid and then wound on a roller cylinder rotating in a strong solution of caustic alkali, for example caustic soda.

806,540. Alonzo C. Hager, Missoula, Montana. **Preserving compound.** Six pounds powdered quicklime and three pounds salt are stirred into 20 gallons water and allowed to stand twenty-four hours, then cream of tartar, potassium nitrate, borax, alum and English soda four ounces each are dissolved in hot water, cooled and stirred into the mixture.

806,564. Ralph D. Peck, Danville, Wis. **Smokeless powder.** Granulated sugar 14, potassium nitrate and potassium chlorate 4 each, magnesium oxide 1 and water six parts by weight.

806,574. George H. Rupley, Schenectady, N. Y. Assignor to General Electric Co., same place. **Insulating material.** A metallic oxide as ZnO is mixed with linseed oil at 500° F., then it is dissolved in CCl<sub>4</sub>, coating the conductor with the solution and heating above 425°; it is then hardened by repeated heating.

806,591. Peter S. Smout, Everett, Washington. Assignor one-half to John A. McGhie and Norval McGhie, same place. **Preserving piles.** A coating composition consisting of tallow 2, rosin and brimstone 20 each, hair and sand to coat the pile.

806,600. Charles F. Stokes, Washington, D. C., Robert C. Turner, Columbus, Ohio. **Sterilizing milk.** A series of tanks are arranged stepwise, the milk flowing from one to the other and a current of electricity is passed in the opposite direction.

806,601. As above for the apparatus.

806,606. Edward B. Weed, Cleveland, Ohio. Assignor to Wood Distilling Co., New York. **Distilling wood.** The balks of wood are slotted crosswise of the grain, and then covered with rosin, and distilled.

806,608. Willis B. Whitney, Boston, Mass., and Ralph C. Robinson, Schenectady, N. Y. Assignors to General Electric Co., N. Y. **Insulating material.** Calcium hydroxide and asbestos are wet enough to make it plastic, molded, the articles soaked in a solution of ammonium carbonate for days, carbon dioxide passed through the solution, the articles thoroughly washed in water and baked at as high a temperature as they will bear.

806,615. Julius Altschul, Berlin, Germany. Assignor to Aktien Gesellschaft für Anilin Fabrikation, same place. **Pepsin compound.** Betain hydrochloride, 4, and pepsin, 6 parts, are mixed

and are capable of digesting proteids in the presence of water.

806,660. Max Hamel, Grunau, near Berlin, Germany. Making concentrated **formic acid**. A formate is dissolved in anhydrous formic acid and concentrated sulphuric acid added to the solution, the mixture distilled, and the vapors condensed.

806,696. Walter S. Hoody, Schenectady, N. Y. Assignor to General Electric Co., same place. **Insulating electrical apparatus**, provided with an insulating casing, is surrounded by oil sprayed into a vacuum and heated.

DECEMBER 12, 1905.

806,774. Horace F. Brown, Oakland, Cal. **Treating ores**. Finely powdered iron ore is reduced while suspended in air by hydrocarbon fuel, the reduced particles being caused to agglomerate, the bonding of the ore being caused by its spongy condition.

806,788. Wm. O. Emery, Crawfordsville, Ind. **Ageing Portland cement**. The heated clinker is sprayed with ammonium bicarbonate, and stack or kiln gases are introduced into the conveyer that carries the cement away from the grinding apparatus.

806,827. Bernice J. Noyes, Boston, Mass. **Bunsen burner**. A perforated diaphragm has a corresponding rotary occluding plate mounted on it and provided with suitable lugs for adjusting the entering air.

806,845. Thomas Rouse and Hermann Cohn, London, England. **Briquette fuel**. A creamy emulsion is made of caustic lime and petroleum to which is added a solution of 4 parts water glass in 80 of water, the whole boiled and used to bond coal dust into briquettes.

806,932. Rudolph Sommer, Vienna, Austria-Hungary. **Organic acid anhydride**. Heated dehydrated salts of the required acid are acted on by silicon tetrafluoride, and the residue heated with sand and sulphuric acid to recover the silicon tetrafluoride.

806,945. John F. Wixford, St. Louis, Mo. **Preparing and feeding reagents**. A suitable solvent is forced through a mass of the reagent and into the material to be treated, and the reagent is renewed at regulated intervals by a quantity equal to that consumed.

806,946. As above for making **cream of lime**. A continuous stream of hot water is passed through a mass of lime to which measured charges are added at stated intervals and the whole thoroughly mixed.

806,954. Mary H. Colahan, Chicago, Ill. Solvent for freeing **bast fibers**. Waste sludge oil is mixed with the spent soda used in preparing paraffine oils and the whole united by heating to 212° F.



806,976. Job R. Inskeep, Galion, Ohio. **Fumigating composition.** Flowers of sulphur 160, willow charcoal 32, New Orleans molasses 16, hickory bark 6, licorice root 4, and lemon peel one part, all in powder.

807,008. John F. Wixford, St. Louis, Mo. **Purifying water.** One grain of sulphate of iron and 6 grains of hydrate of lime are added to each gallon of water at separate points in the conduit, the lime being in excess of the amount required to satisfy the carbon dioxide and the sulphate, and the reagents being added in separate streams of water flowing through the masses of said reagents, and delivered into the flowing stream of water to be purified.

807,019. Alan A. Claflin, Littleton, Mass. **Lactic mordant.** Consists of a neutral ammonium salt and free lactic acid in excess.

807,026. Paul L. T. Héroult, La Praz, France. Assignor to Société Electro-Métallurgique Française, Froges, Isere, France. **Converting cast iron to steel.** The cast iron is first oxidized till all phosphorus is oxidized, then the slag is removed and the metal transferred to an electric furnace to complete the conversion.

807,027. As above, for **mixing steel.** Metal from a number of converters is mixed in an electric furnace in the presence of a gas free from oxygen, whereby perfect desulphurization is obtained.

807,034. Franz von Kugelgen and George C. Seward, Holcombs Rock, Va. **Decarburizing iron.** It is first reduced with plenty of carbon and then made into anodes and decarbonized in an electric furnace in the absence of carbon and in the presence of the slag or furnace lining which eliminates the carbon.

807,117. George Kalischer, Frankfort-on-Main, Germany. Assignor to Cassella Color Co., New York, N. Y. **Sulpho acid.** 1-2-Diaminonaphthalene-5-hydroxy-7-sulphonic acid, one molecule, is condensed in aqueous solution with two molecules of an aromatic aldehyde, forming yellowish powders, insoluble in water, alcohol and ether, soluble in alkalies from which solutions they are precipitated by acids.

807,119. Felix Klingemann and George Kalischer, Frankfort-on-Main, Germany. Assignors to Cassella Color Co., New York, N. Y. **Red azo dye.** One molecule of 1,2-diaminonaphthalene-5-hydroxy-7-sulphonic acid is condensed with two molecules of a monoazo dye from *m*-aminobenzaldehyde and  $\alpha$ -naphtholsulphonic acid. The product is a trisazo powder of reddish brown shade, soluble in water red, in strong sulphuric acid blue-red, turning yellow on dilution with water.

807,181. Charles Oswald, Hermann Loretan, and Charles De La Harpe, Basel, Switzerland. Assignors to Durand Huguenin Co., same place. **Yellow-green dye.** Formaldehyde is made

to react on gallocyanin dyes. The product dissolves in water rose color, turning to intense red by adding sodium nitrite, but gives blue-green in strong sulphuric acid, turning red on dilution with water, and forming a blue dye on heating with water or salt solutions.

807,182. As above for **green dye**. The dye of the last patent is reduced. Reactions are similar to those of the preceding dye but with sodium acetate it gives a yellow precipitate.

807,249. Albert P. Cromwell, Florida, N. Y. **Insecticide**. Benzin 20, hellebore, night shade and laurel 4 each, and water 130 parts by weight.

807,250. Charles F. Cross, London, England. **Sugar from cellulose**. Cottonseed hulls are treated first with an alkaline solution, then with chlorine and finally with an alkaline solution, the mass being broken up and suspended in water, the portion that settles being collected and hydrolyzed.

807,271. Antoine H. Imbert, Grand Montrouge, France. **Extracting metals**. The necessary copper and fluxes are added to ores containing zinc and lead, the zinc is sublimed and the lead drawn off in a melted state, the scoria and copper sulphide are separated and the copper recovered.

807,281. Thilo Kroeber, Basle, Switzerland. Assignor to Society Chemical Industry, same place. **Brown azo dye**. Triaminobenzene derivatives are coupled with derivatives of *o*-diazophenol. The dyes are soluble in water yellow-brown, dyeing wool brown from an acid bath.

807,300. Charles Mayerling, Zichyfalva, Austria-Hungary. **Liquid lenses**. Hollow lens halves are immersed in the filling liquid, then the edges sealed by thick water glass; while in the liquid the lens is removed, the edge further cemented by water glass and the whole dipped in hydrochloric acid to harden it.

807,412. John F. Wixford, St. Louis, Mo. **Purifying water**. A stream of water runs through fluoride of iron into the water to be purified and further on in the flowing stream, calcium hydroxide is introduced in the same way, the chemicals being proportioned to the character of the water.

807,422. Karl Elbel, Biebrich, Germany. Assignor to Kalle and Co., same place. **Zinc azo naphthol dye**. 1-Amino-2-naphthol-4-sulphonic acid is treated with sodium nitrite in the presence of zinc sulphate, the product being combined with  $\beta$ -naphthol, giving a dark brown powder, soluble in water and soda solution blue-red, turning black by chroming.

DECEMBER 19, 1905.

807,453. John W. Fries, Winston-Salem, N. C. **Indigo dye**. A padding liquor for indigo dyeing which consists of a mixture

of indigo powder 4, lime 12, zinc dust 4, caustic soda, starch, and alizarin oil 2 each, mixed with water to form a solution.

807,491. Harry Pauling, Brandau, Austria-Hungary. **Manufacturing nitric acid.** Atmospheric air is treated with the electric spark and fresh quantities of air added to that already treated; the mixture is then exposed to the action of dark electric discharges, and moisture added to the mixture.

807,494. Francis I. DuPont, Wilmington, Del. **Smokeless powder priming charge.** Consists of a skeleton of smokeless powder, comprising partitions, forming between them cells which are open at their outer ends, and some or all of which contain a quick burning powder.

807,501. Alfred Schwarz, New York, N. Y. Assignor to the Schwarz Ore Treating Co., Phoenix, Ariz. **Concentrating ores.** A non-sulphide ore is treated with a soluble sulphide, such as sodium or potassium sulphide, to convert it into a sulphide; the mass is then treated with a hydrocarbon, such as melted paraffin, which is finally separated with the entrapped metallic constituents.

807,502, 807,503, 807,504, 807,505, 807,506. Same. A paraffin which is solid at normal temperatures is made use of in causing the metallic constituents of the ore to adhere to it, from which the metal is finally removed.

807,553. Alex. Haase, Hanover, Germany. **Treatment of wicks.** To increase the inflammability of wicks of candles or tapers their ends are treated before the candle is formed about them, in a solution of celluloid in acetone, and the acetone evaporated.

807,567. Frederick J. Maywald, New York, N. Y. Assignor to Edward H. Fallows, New York. **Extracting oil and grease.** Oil and grease are separated from water or from similar liquid, and from material floating or in suspension therein, by adding carbon tetrachloride thereto and allowing it to descend through the mass and separate by difference in specific gravity. The carbon tetrachloride is then drawn off and separated from the oil, etc., by distillation.

807,609. Carleton Ellis, Boston, Mass. **Hydrating lime.** Dry, pulverulent calcium hydroxide is made by continuously mingling a stream of quicklime with a stream of water in suitable proportions and the resulting stream of lime putty is subjected to continuous agitation and the reaction accelerating action of heat from a progressively advancing, adjacent, heat-imparting mass of lime in an advanced state of hydration until water absorption is substantially completed, and the expansion due to incipient hydration has begun; then the progressing stream is in turn made to be the heat-imparting agent and is vigorously agitated until converted into dry calcium hydroxide.



807,629. Eugene C. May, Chicago, Ill. Assignor to National Garbage Fuel Co., Chicago. **Artificial fuel.** An agent consisting of oil and hydrochloric acid is commingled with the stock made from prepared garbage, the oil being in proportion of about 3 per cent. and the acid about 0.5 per cent.

807,640. Isaiah L. Roberts, Brooklyn, N. Y. Assignor to Roberts Chemical Co. **Manufacture of hydrochloric acid.** Regulated amounts of hydrogen and chlorine are produced by electrolysis, in the relative proportions in which they combine. The two gases are conducted in separate streams to a common point and caused to impinge upon each other, and are burned at this point, one gas supporting the combustion of the other. The acid formed is conducted off and recovered.

807,649. William E. Wilkinson, Chicago, Ill. **Cleansing compound.** A composition of matter for cleansing and polishing flat irons composed of an abrasive substance as emery 68, an alkaline soap 1, paraffin 5, soda ash 5, mineral oil 2, resin 18 and water to form a paste.

807,667. William P. Dunbar, Hamburg, Germany. **Biological purification of liquids.** The material is placed on a percolating bed increasing in coarseness from the surface downward; the liquid portions are distributed over the bed by the action of the topmost layer and a dripping of the liquid portions is produced between the large pieces of the lowermost layer; the sides of the layers of the filtering materials are directly exposed to the atmosphere and a natural circulation of air is caused from the sides of the bed to the interior and out again by the heat set up by the oxidation in the bed, whereby the liquid dripping between the coarse pieces is surrounded by air.

807,668. Carl Schlickeysen, Steglitz, Germany. **Treating raw peat.** Raw peat is converted into solid peat fuel by mixing it with solid combustible granular matter, kneading it and heating it superficially to approximately  $100^{\circ}$  while the interior is maintained in its cold state as it leaves the kneading machine in the form of bars; granular combustible material is impressed upon the heated surface of the bars and allowed to dry.

807,782. Albrecht Schmidt, Höchst-on-Main, Germany. Assignor to Farbwerke vorm. Meister, Lucius & Brüning, same place. **Brominating indigo.** A mixture of indigo and about 20 to 50 per cent. of water is subjected to the action of bromine, whereby aqueous hydrobromic acid is formed and acts upon the indigo.

807,932. Rudolph Isenman, Newark, N. J. **Coloring photographic prints.** The photographic print is treated with a solution of lemon juice and ferrocyanide of potassium, and subsequently with ferrous sulphate.

807,962. Greenleaf W. Pickard, Amesbury, Mass. Assignor to American Telephone and Telegraph Co. **Lightning arrester.** A porous carbon block is immersed in a solution of rosin in turpentine, then dried to harden or set, and then the binding material is ground off from one face of the block to leave a rough surface of carbon.

807,973. Pierre Steenlet, Brussels, Belgium. Assignor to Marcel Perrew Lloyd, Brussels. **Obtaining electrolytic deposits.** A diaphragm is charged with an organic substance which has been rendered insoluble, and the charged diaphragm interposed between a metallic anode and cathode and the corresponding portions of an electrolyte containing a metal; an electric current is made to flow through the charged diaphragm and a metallic deposit formed upon the cathode.

807,983. James P. Wintz, Sourlake, Tex. **Treating petroleum oils.** Asphaltum is separated from crude petroleum by gasoline and sulphuric acid and then treated with gasoline, water and caustic soda; it is then passed through an evaporator.

808,033. Erastus M. Flynn, Lebanon, Mo. **Fire kindler.** Asbestos cement, fire-clay, diamond dust, and black lead in equal parts.

DECEMBER 26, 1905.

808,066. Wilhelm Borchers and Lorenz Stockem, Aachen, Germany. **Producing metallic calcium.** Anhydrous calcium salts are fused and then electrolyzed, the small cathode being maintained cool enough to prevent the depositing calcium from melting and causing the deposition thereof in the spongy state.

808,095. Walther Lang, Salbke-on-Elbe, Germany. **Manufacture of organic compounds.** This is an oxidation process in which use is made of a manganous salt electrolyzed to form a manganic salt. By this means an aldehyde may be formed by the oxidation of the corresponding hydrocarbon.

808,100. Florentine J. Machalske, Brooklyn, N. Y. Assignor to Frederick Darlington, Great Barrington, Mass. **Making chlorides of carbon.** Calcium oxide, calcium chloride and carbon adapted to react and form oxychlorides of carbon are subjected to the heat of the electric furnace sufficient to effect the reaction, and the oxychlorides of carbon are subsequently decomposed into carbon tetrachloride and carbon dioxide.

808,103. Guy L. Meaker, Evanston, Ill. Assignor to the American Steel & Wire Co. of New Jersey. **Galvanizing metals.** The metal is subjected to the action of an electric current in an electroplating apparatus in the presence of an electrolyte composed of a combined solution of zinc chloride 1, zinc sulphate 2 parts and a small proportion of a vegetable acid.

808,105. George W. Morse, Jersey City, N. J. Assignor to Clarion Chemical Co., New York, N. Y. **Dentifrice.** The combination powder, barium hydrogen orthophosphate and barium dioxide 17 per cent., precipitated chalk about 75 per cent., and castile soap 8 per cent.

808,141. George D. Coleman, Boston, Mass. **Making lead hydroxide.** Comminuted metallic lead, water and air are mixed in a closed vessel and ground together, the temperature being maintained at less than 100° F. The product is drawn off with some of the water which is again returned to the apparatus; the air deficient in oxygen is also drawn off and fresh quantities supplied, making a continuous process.

808,240. Alexandre Jacob, Vilvorde, Belgium. **Disincrustant for steam generators.** Soda salt 4, acetic acid 2, chicory 1, logwood 2, and marine salt 1 part.

808,331. Eugene Albert, Munich, Germany. Assignor to Ferdinand Wesel, New York City. **Separation of galvanoplastic deposits from metal matrices.** A metallic bath is employed, being heated to a point lower than the fusing point of the matrix, and the deposit and matrix are floated thereon.

808,339. John C. Butterfield, London, England. **Road-making.** A suitable available material is reduced and the finer separated from the coarser portion; the finer is mixed with granulated asphaltum or the like, lime or chalk, a silicate of soda and a saccharine substance, thereby forming a plastic mass capable of setting hard, and thereafter the coarser material is embedded in it.

808,361. Herbert Haas, San Francisco, Cal. **Roasting ores.** The ores are mixed with a suitable flux in suitable proportions and a sintered agglomeration created by raising the ore-flux mixture to the ignition point of the sulphur or other metalloids, and then subjecting the mass to a light blast of air for a sufficient time and with sufficient strength to oxidize and drive off the more easily separable metalloids, while maintaining the heat below a smelting temperature. When this part of the operation is complete the blast is increased to drive off the less easily separable metalloids, the air current being maintained in proportion of the amount required for combustion, and is decreased as the amount of sulphur and other metalloids remaining to be oxidized decreases.

808,382. Felix Jottrand, Uccle, Belgium. **Oxy-hydrogen blowpipe.** There are a mixing chamber and a suction chamber in combination, the suction chamber communicating with the mixing chamber by a passage of precalculated size and provided with a port for supplying gas at a relatively low pressure; a nozzle is placed at the center of the suction chamber, and there is a tube for supplying relatively high pressure gas to the nozzle.



808,398. Hermann Muller, Paris, France. **Indigo dyeing.** The fabric or analogous material to be dyed is fed through a dyeing machine having a dye receptacle and is subjected to a bath composed of indigo 50, an oxide of tin 150, dissolved in acetic acid, and poured into an alkaline solution; it is then aired and finally treated with a solution of potassium bichromate and hydrochloric acid.

808,407. Bruno R. Seifert, Radebeul, near Dresden, Germany. Assignor to Chemische Fabrik von Heyden Aktiengesellschaft, same place. **Making guanyldialkylbarbituric acid.** Dicyandiamidine and dialkylmalonic acid dialkyl esters are heated with a suitable condensing agent as sodium alcoholate.

808,421. Frank M. Williams, Potsdam, N. Y. **Specific gravity balance.** There is a pivoted beam having one arm graduated and adapted to receive weights or riders, and the other arm screw-threaded; there is a plummet suspended from the graduated arm, and a counter weight adapted to travel on the screw-threaded arm; and a member removably suspended from the screw-threaded arm which supports a plurality of pans or receptacles.

808,443. Moritz von Gallois, Höchst-on-Main, Germany. Assignor to Farbwerke vorm. Meister, Lucius & Brüning, same place. **Printing indigo.** In printing fabrics with indigo on white or Turkey-red dyed unprepared cotton, there is simultaneously applied in the printing color a mixture of indigo and stable double compounds of hydrosulphites with aldehydes and strong caustic alkalies.

808,453. Arthur E. Hobson, Meriden, Conn. **Silver alloy.** Contains 925 parts of silver and the remainder to 1,000 parts consisting of other metals including manganese.

808,483. William Simpkin, Westminster, and James B. Ballantine, Twickenham, England. **Manufacture of briquettes.** Blood and coal dust in the proportion of 100 to 200 parts of blood to 2,000 parts of coal; 15 to 20 parts of nitrate of potassium to 2,000 parts of blood; about 10 parts of resin to 100 parts of blood; and 20 to 30 parts of slaked lime to 2,000 parts of coal.

808,542. Joseph H. Hines, Philadelphia, Pa. **Enameling.** In enameling and coloring metallic articles, they are first cleaned and placed in an alkaline bath to prevent corrosion or oxidation; the alkaline substance is allowed to dry on the surface and a coat of enamel is then applied; the coloring-matter is then applied and the article placed in the furnace to burn it on; afterward another coat of enamel is applied and burnt on the article.

W. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**A Preliminary Reconnaissance of the Mancayan-Suyoc Mineral Region, Lapanto, P. I.** BY A. J. EVELAND. *Mining Bureau, Manila, Bull.* 4, 58 pp.; maps, numerous plates.—This region, directly north of Manila, a producer of copper in past years, but extremely difficult of access, seems to merit further attention. A few analyses of rocks, ores and waters appear in the report. W. F. HILLEBRAND.

**The Coal Deposits of Batan Island with Notes on the General and Economic Geology of the Adjacent Region.** BY W. D. SMITH. *Mining Bureau, Manila, Bull.* 5, 56 pp.; maps, plates.—This is a more detailed report than that made by Lieut. Wigmore and others (this Journal, 28, R 179), but it does not settle the extent of the deposits. W. F. HILLEBRAND.

**On Crystalline Habit.** BY F. G. COTTRELL. *J. Physic. Chem.* 10, 52-57.—The differences in surface-tension and solubility among the faces of a crystal will determine the growth of the faces and hence the crystalline habit only when the degree of supersaturation of the solution is of the same order of magnitude as such differences in solubility. Experimental work indicates that these differences are very slight, and this factor appears to be negligible for crystals grown under ordinary laboratory conditions. The true explanation of crystal habit from the practical standpoint must therefore be sought, not as heretofore (Gibbs, Curie) in terms defining the equilibrium between the crystal and its solution, but on the contrary in terms of the rate of growth of the various faces. E. C. SULLIVAN.

**Paragenesis of the Cobalt-Nickel Arsenides and Silver Deposits of Temiskaming.** BY W. CAMPBELL AND C. W. KNIGHT. *Eng. Min. J.* 81, 1089-1091; figures.—The authors examine

flat polished reflecting surfaces of ore specimens by means of the microscope. The following is believed to be the order in which the minerals were deposited: Smaltite-chloanthite, niccolite, calcite, argentite, native silver, decomposition products (erythrite, annabergite, etc.). Smaltite-chloanthite ( $\text{CoAs}_2\text{NiAs}_2$ ), homogeneous to the eye, is shown to be made up of more than one constituent. Partially roasted ore fused with borax and cooled slowly reveals structures "strikingly similar to those seen in the ore itself."

E. C. SULLIVAN.

**Note on Two Interesting Pseudomorphs in the McGill University Mineral Collection.** BY R. P. D. GRAHAM. *Am. J. Sci.* 22, 47-54.—Description and analyses of a pseudomorph of orthoclase after laumontite and of a pseudomorph after corundum, the formation of which seems to have been begun by a thin coating of tourmaline, which was followed by the alteration of the corundum kernel to a mineral resembling scapolite, this in turn going over into pinitite.

E. C. SULLIVAN.

**Datolite from Westfield, Massachusetts.** BY E. H. KRAUS AND C. W. COOK. *Am. J. Sci.* 22, 21-28; figures.—Crystallographic data with analyses which show close agreement with the theoretical composition.

E. C. SULLIVAN.

**The Estacado Aerolite.** BY KENNETH S. HOWARD AND JOHN M. DAVISON. *Am. J. Sci.* 22, 55-60.—A description of this 290 kg. meteorite, with analyses. The minerals of the stony portion are mainly olivine and enstatite, as shown by analyses of the material soluble and insoluble in hydrochloric acid. The bulk analysis gave the following results: Fe, 14.68 per cent.; Ni, 1.60; Co, 0.08; Cu, trace; S, 1.37; P, 0.15;  $\text{SiO}_2$ , 35.82;  $\text{FeO}$ , 15.53;  $\text{MgO}$ , 22.74;  $\text{CaO}$ , 2.99;  $\text{Al}_2\text{O}_3$ , 3.60;  $\text{Na}_2\text{O}$ , 2.07;  $\text{K}_2\text{O}$ , 0.32; C,  $\text{TiO}_2$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{MnO}$  found but not determined. Total, 100.95. Less O for S, 0.68. Net total, 100.27. Sp. gr. 3.63.

E. C. SULLIVAN.

**On Stibiotantalite.** BY S. L. PENFIELD AND W. E. FORD. *Am. J. Sci.* 22, 61-77.—"Stibiotantalite is a mineral first found in rounded, water-worn pebbles in Australia and recently in well-crystallized specimens in San Diego County, California. In chemical composition it is an isomorphous mixture of  $(\text{SbO})_2\text{Nb}_2\text{O}_6$  and  $(\text{SbO})_2\text{Ta}_2\text{O}_6$ , exhibiting a wide range in specific gravity, from 5.98 to 7.37, depending upon the proportions of  $\text{Nb}_2\text{O}_5$  and  $\text{Ta}_2\text{O}_5$  present." The mineral was analyzed by decomposing with hydrofluoric acid in the cold, precipitating bismuth and antimony with hydrogen sulphide, and weighing columbic and tantallic oxides together, the relative quantities of these being calculated from the specific gravity of the mixture. The results, with the original analysis of the Australian material, were:



	Sp. gr.	(Ta <sub>7</sub> Nb) <sub>2</sub> O <sub>5</sub> .	Sb <sub>2</sub> O <sub>3</sub> .	Be <sub>2</sub> O <sub>3</sub> .	NiO.	H <sub>2</sub> O.	Totals.
Australia.....	7.37	58.69	40.23	0.82	0.08	0.08	99.90
California.....	6.72	55.33	44.26	0.33	.....	.....	99.92
California.....	5.98	50.30	49.28	0.53	.....	.....	100.11

The calculated percentages of Ta<sub>2</sub>O<sub>5</sub> and Nb<sub>2</sub>O<sub>5</sub> are respectively 52.16 and 6.53, 36.35 and 18.98, 11.16 and 39.14. "The crystals belong to the hemimorphic group of the orthorhombic system although, owing to twinning, they imitate the symmetry of the normal group. In axial ratio, development, and occurrence of several forms, the mineral is related to columbite. Stibiotantalite is characterized by an unusually high index of refraction, above diamond, a high birefringence, and a wonderful luster."

E. C. SULLIVAN.

**The Clay Deposits of the Virginia Coastal Plain.** By HEINRICH RIES. *Geol. Survey Virginia, Geol. Series Bull. II*, 184 pp.; map, plates, figures.—A detailed discussion of the origin, occurrence, and physical and chemical properties of clay and the manufacture of clay products, with particular reference to certain Virginia deposits. The paper is accompanied by a large number of analyses.

E. C. SULLIVAN.

**A Remarkable Specimen of Zinc Blende.** By W. R. INGALLS. *Eng. Min. J.* **81**, 894.—The specimen, probably from Chihuahua, Mexico, exhibits triboluminescence to a remarkable degree. One side of the specimen shows plainly the selvage between the ore and the wall. Then come bands made up respectively as follows: blende and galena; blende, pyrite, chalcopyrite and calcite; blende with a little pyrite and calcite; chalcopyrite; blende and calcite; and galena. The blende is of the grayish brown variety—"resin blende"—with some small crystals of ruby blende.

E. C. SULLIVAN.

## METALLURGICAL CHEMISTRY.

**Notes on Irreversibility of Heusler Alloys.** By BRUCE V. HILL. *Physical Review*, **21**, 335-342 (1906).—The Heusler alloys are magnetic alloys of copper, manganese and aluminum. They were cast into rods which were tested by the ballistic method, the change of induction with temperature being measured. The heating was done electrically by means of a nickel coil. This alloy differs from the irreversible nickel steel, in that it was magnetic when first cast. Cooling to low temperature had little effect. When heated and cooled to room temperature the permeability varied with the temperature to which it had been carried, showing minimum in the neighborhood of 500°. The density of the alloy is greater in the magnetic than in the unmagnetic state, which also is the reverse of the condition in the alloys of nickel-iron.

F. E. GALLAGHER.

**The Equilibrium Curves of the System of Iron and Carbon.**

By PROF. H. V. JÜPTNER. *Iron and Steel Mag.* May, 1906, 377-382.—This is a comparative revision of various determinations of the solidus and liquidus lines of the iron-carbon system. The works of Carpenter and Kelling, Mannesmann and Osmond, Roberts-Austen and F. Wust are examined, their points plotted and the diagram drawn. The points found by Carpenter and Kelling, and by Wust are considered the most reliable. The intersection of the eutectic line with the "end of solidification" line occurs at 2.07 per cent. of carbon. The eutectic point is at 4.3 per cent. of carbon. The equation of Rothmund is applied to these curves in order to calculate the size of the molecule of carbon dissolved in iron. The unsatisfactory results, however, show that the latent melting heat is not closely known.

F. E. GALLAGHER.

**Cooling Curves of Metallic Solutions.** By THOMAS T. READ.

*Iron and Steel Mag.* February, 1906, 96-99.—A couple of type cases of cooling curves are discussed with an explanation of the meaning and cause of the breaks. The article does not pretend to bring out any new points but is simply given as a review for the benefit of metallographists. After showing an ideal freezing-point curve, a curve obtained from cooling molten tin is shown, in connection with which supercooling is discussed. A tin-zinc curve of two branches is shown and described.

F. E. GALLAGHER.

**An Etching Method for Determining whether Steel Has Been Made by the Crucible Process.** By JAMES A. AUPPERLE.

*Iron and Steel Mag.* May, 1906, 383-385.—It is difficult and often impossible to tell by chemical analysis whether or not a steel has been made by the crucible process. Oxygen and silicon determinations are not reliable, as has been shown at the laboratory of the Illinois Steel Co. The treatment of a steel can be discovered by etching. Specimens are treated with dilute sulphuric acid and potassium permanganate and allowed to stand over night. The open-hearth or Bessemer steel will be etched in grooves in the direction of rolling and the cross-section at the edge will be honey-combed. The crucible steel will show a close structure, often minute pittings. They can be examined by the unaided eye or by a microscope.

F. E. GALLAGHER.

**Metallography Applied to Foundry Work. Part IV.** By

ALBERT SAUVEUR. *Iron and Steel Mag.* November, 1905, 413-419.—The photomicrography of prepared samples of cast iron is discussed in this instalment. The camera and its method of attachment to the microscope are shown by a figure. Such manipulations as illumination of the samples, focusing, exposure, development of the plate, printing and mounting are described.

F. E. GALLAGHER.

**Metallography Applied to Foundry Work. Part V.** BY ALBERT SAUVEUR. *Iron and Steel Mag.* February, 1906, 119-124.—The microstructure of cast iron. The difference between grey and white cast irons is shown by photomicrographs, and the influence of graphite on the properties of iron is discussed. It is suggested that the strength of cast iron would be increased by (1) reducing the amount of graphite, (2) by decreasing the size of the graphite particles, (3) by regulating the shape of the graphite particles, causing them to occur as rounded grains rather than as curved plates. The last two might be effected by proper heat treatment.

F. E. GALLAGHER.

**The Double Cyanides of Copper.** BY LEONARD M. GREEN. *Eng. Min. J.* 80, 927-928.—The paper presents a method by means of which the amounts of potassium cupric cyanide ( $\text{K}_2\text{Cu}(\text{CN})_4$ ) and of potassium cuprous cyanide  $\text{KCu}(\text{CN})_2$  and "total cyanide" may be estimated in a solution which contains copper and potassium cyanide. It is indicated that potassium cupric cyanide is a solvent for metallic gold or silver, while potassium cuprous cyanide is practically inert. It is possible, therefore, to obtain a working cyanide solution which apparently (according to the silver nitrate "total cyanide test") contains no available cyanide, and which still possesses considerable solvent power.

The reaction is as follows:



Such a solution has a large potential solvent power, which may be developed by precipitation of the copper in potassium cuprous cyanide. After a solution has been for some time in contact with the ore and potassium cuprous cyanide is at a maximum, by passing the solution through the zinc boxes, copper is precipitated and the amount of potassium cupric cyanide is increased. This somewhat astonishing result is probably due to the redissolving of some of the metallic copper which has been deposited.

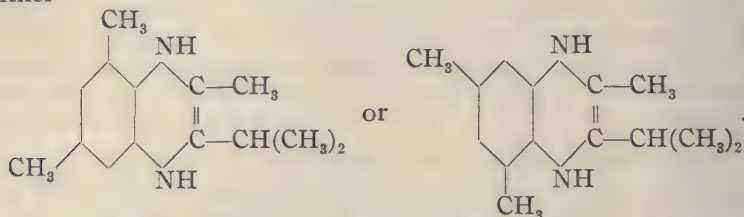
LAUDER W. JONES.

## ORGANIC CHEMISTRY.

**On a Second  $\alpha,\delta$ -Dihydroquinoxaline.** BY JOHN B. EKELEY. *Ber.* 39, 1646-1649.—Ekeley and Wells have shown recently that when *o*-phenylenediamine is condensed with acetone or with mesityl oxide, in presence of dry hydrochloric acid gas, an  $\alpha,\delta$ -dihydroquinoxaline results. It is now found that a similar condensation can be carried out with 1,2,3,5-xylylenediamine and mesityl oxide. Various salts and reactions of the product are described. **EXPERIMENTAL.** 1,2,3,5-xylylenediamine was dissolved in excess of mesityl oxide, and the cooled solution treated with dry hydrochloric acid gas. The hydrochloride of



the quinoxaline precipitated. By dissolving this in water and adding potassium hydroxide, the base was liberated, and it was then purified by crystallization from dilute acetone. It forms straw-yellow needles, m. p.  $82-83^{\circ}$ , easily soluble in the ordinary organic solvents or in acids. The structure of the product is either



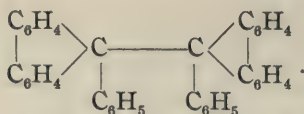
*Hydrochloride*.—When dry hydrochloric acid gas is passed through an ethereal solution of the base, a yellow crystalline precipitate separates at first which rapidly changes to white. The white salt is a dihydrochloride, while the yellow one is probably a monohydrochloride. Hydrobromic and hydroiodic acids show the same behavior. If dry hydrochloric or hydrobromic acid gas act upon a chloroform solution of the base, the result is a colloidal solution of the corresponding salt.

*Picrate*,  $C_{14}H_{20}N_2 \cdot 2C_6H_2(OH)(NO_2)_3$ ; beautiful, yellow needles. A *nitroso derivative* results when an acetic acid solution of the base is treated with potassium nitrite. Alcoholic solutions of the base precipitate solutions of copper sulphate and of mercury chloride.

M. T. BOGERT.

**On Triphenylmethyl** (Thirteenth Paper). BY M. GOMBERG AND L. H. CONE. *Ber.* 39, 1461-1470.—The authors prepared several polyphenylated ethane derivatives, in the hope that a study of their properties would throw some light upon the problem of the constitution of triphenylmethyl. The method of preparation consisted in allowing triphenylmethyl chloride, or similar halides, to react with various magnesium alkyl (or aryl) halides:  $(C_6H_5)_3CCl + MgRX = (C_6H_5)_3CR + MgXCl$ . In this way, the following were prepared:  $(C_6H_5)_3C.C_6H_5$ ,  $(C_6H_5)_3C.CH_2.C_6H_5$ ,  $(ClC_6H_4)(C_6H_5)_2C.CH_2C_6H_5$ ,  $(ClC_6H_4)_3C.CH_2C_6H_5$ ,  $(BrC_6H_4)_3C.CH_2C_6H_5$ ,  $(ClC_6H_4)_2(C_6H_5)C.CH_2C_6H_5$ ,  $(BrC_6H_4)_2(C_6H_5)C.CH_2C_6H_5$ ,  $(C_6H_5)_3C.CH_3$ ,  $(C_6H_5)_3C.C_2H_5$ , and  $(C_6H_5)_3C.CH(C_6H_5)_2$ . The yield in nearly every case was quantitative, and most of the compounds crystallized exceptionally well. The unsymmetrical tetraphenylethane,  $(C_6H_5)_3C.CH_2C_6H_5$ , was found to agree in melting-point and solubilities with a hydrocarbon previously described in the literature as "diphenylenephylmethane." **EXPERIMENTAL**.—*Tetraphenylmethane*,  $(C_6H_5)_4C$ , may be easily prepared by the interaction of a benzene solution of triphenylmethyl chloride upon an ethereal solution of phenylmagnesium

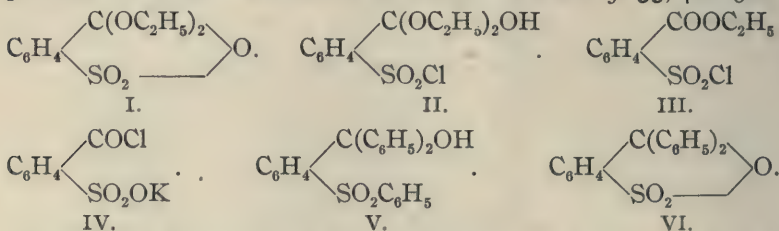
bromide, although the yield is only 5-10 per cent. *Unsymmetrical Tetraphenylethane*,  $(C_6H_5)_3C.CH_2.C_6H_5$ , was prepared from triphenylmethyl chloride and benzylmagnesium chloride. The yield was quantitative. The compound separates from solution in a mixture of ether and petroleum ether in beautiful transparent crystals, which are apparently monoclinic. *p-Monochlorotetraphenylethane*, from monochlorotriphenylmethyl chloride and benzylmagnesium chloride, melts at  $156^\circ$ . *o,p',p''-Trichlorotetraphenylethane*.—By the interaction of carbon tetrachloride and chlorbenzene, by the Friedel-Crafts method, the *o,p',p''*-trichlor derivative results, together with a small amount of the *p*-trichlor compound. The *o,p',p''*-trichlor chloride couples quantitatively with benzylmagnesium chloride. The product crystallizes from alcohol in beautiful snowy crystals, m. p.  $140^\circ$ . *Tri-p-bromtetraphenylethane*.—When the Friedel-Crafts reaction is carried out with carbon tetrachloride and brombenzene, the chief product is the tri-*p*-brom compound, with but little of the *o,p',p''*-derivative. On coupling the tri-*p*-brom compound with benzylmagnesium chloride, there resulted a quantitative yield of tribromtetraphenylethane, which separated from ether in beautiful crystals, m. p.  $201^\circ$ . Tetraphenylethane derivatives were also prepared from the following, and will be described in a later paper: Di-*p*-chlorotriphenylmethyl chloride, liquid; corresponding carbinol, m. p.  $87^\circ$ ; di-*p*-bromotriphenylmethyl chloride, m. p.  $100^\circ$ ; carbinol, m. p.  $110^\circ$ ; *o,p'*-dichlorotriphenylmethyl chloride, m. p.  $107-109^\circ$ ; *o*-chlorotriphenylmethyl chloride, m. p.  $133^\circ$ ; carbinol, m. p.  $91^\circ$ . *1,1,1-Triphenylethane*,  $(C_6H_5)_3C.CH_3$ , from triphenylmethyl chloride and methylmagnesium iodide, crystallizes from alcohol in white needles, m. p.  $94-95^\circ$ , and is identical with the substance previously obtained by Kuntze-Fechner from triphenylmethyl bromide and zinc methyl. *1,1,1-Triphenylpropane*,  $(C_6H_5)_3C.CH_2CH_3$ , from triphenylmethyl chloride and ethylmagnesium iodide, could not be obtained in crystals. *Pentaphenylethane*,  $(C_6H_5)_3C.CH(C_6H_5)_2$ , was prepared by the action of "active" magnesium upon an ethereal solution of triphenylmethyl chloride and diphenylethyl bromide. It crystallizes from petroleum ether in snowy tablets, which appear to belong to the monoclinic system. The substance is easily soluble in carbon disulphide or in benzene, slightly soluble in ether, and very difficultly soluble in alcohol or in petroleum ether. It begins to soften at  $165^\circ$ , and melts with decomposition at  $175-180^\circ$ . It is readily attacked by bromine. *On the Hexaphenylethane Question*.—By the action of silver upon a benzene solution of biphenylenetriphenylmethyl chloride, a beautiful crystalline hydrocarbon was obtained (m. p.  $193^\circ$ ), which probably has the constitution



The authors hope to prepare a magnesium derivative of biphenylenephenylmethyl chloride, and by condensing this with triphenylmethyl chloride to obtain a hydrocarbon closely related to hexaphenylethane. Plans for obtaining hexaphenylethane itself are also outlined.

M. T. BOGERT.

**Further Investigations of the Two Chlorides of Orthosulphobenzoic Acid.** BY PHILIP H. COBB. *Am. Ch. J.* 35, 486-508.



**I. Action of Hydrochloric Acid on Organic Anhydrides.**—It had been suggested that the formation of symmetrical ester chlorides by the action of alcohols on the low melting chloride might take place as follows: The chloride and alcohol would give an anhydride (formula I) which with the hydrochloric acid produced in the reaction would give a compound (formula II), and finally this would lose alcohol giving the ester chloride (formula III). Hydrochloric acid on anhydrides of dibasic acids failed, however, to give any such result. **II. The Action of Alcohols and Alcoholates on the Chlorides.**—The methyl alcoholic solution of the low-melting chloride, when evaporated in a current of air, gave the orthosulphone chloride of methyl benzoate; when boiled, the ester acid, methyl orthosulphobenzoate. The higher-melting chloride and methyl alcohol acted less readily, but, when boiled, gave the same ester acid and a body supposed to be a mixture of the ester acid and orthosulphobenzoic acid. **III. Action of Sodium Ethylate on the Chlorides.**—An ethereal solution of the high-melting chloride and an alcoholic solution of sodium ethylate gave a small yield of the diethyl ester of orthosulphobenzoic acid. Addition of the dry ethylate to the ethereal solution of the chloride gave a theoretical yield of the same neutral ester. The low-melting chloride gave a similar product. **IV. Action of Benzene and Aluminum Chloride.**—Orthobenzoyldiphenyl sulphone was the only product obtained from either chloride though the conditions were varied greatly. **V. Experiments with Thionyl Chloride.**—Both the acid and the neutral potassium salts of orthosulphobenzoic acid were treated with thionyl chloride without



getting a yield of either of the isomeric chlorides. When alcohol was added to the reaction-product of the thionyl chloride and the neutral salt, a small amount of the potassium salt of the ester acid was obtained. This proved the presence of a small amount of a body of the formula IV in the reaction product. VI. *Experiments with Magnesium-phenyl Bromide.* The high-melting chloride gave a product (formula V), melting at  $183-184^{\circ}$ , not affected by alcoholic potassium hydroxide solution, but giving a red color with concentrated nitric and sulphuric acids, a carbinol reaction. The product from the low-melting chloride was not identified. Sulphobenzoic anhydride and magnesium-phenyl bromide gave a 10 per cent. yield of a diphenyl derivative (formula VI) melting at  $163^{\circ}$ . It dissolves in alcoholic potassium hydroxide solution, on boiling, with the formation of a salt soluble in water. On acidification, the original substance is precipitated. It is apparently the same substance that was obtained in small quantity by Remsen and Saunders and by List and Stein by the action of benzene and aluminum chloride on the mixed isomeric chlorides.

V. J. CHAMBERS.

#### The Reaction of Nitrous Anhydride with Ethyl Malonate.

BY RICHARD SYDNEY CURTISS. *Am. Ch. J.* 35, 477-486.—Nitrous anhydride reacted on ethyl malonate at low temperatures giving a green oil consisting of the anhydrous and the hydrated mesoxalic esters, together with small amounts of oxalic acid and ester, acetic acid and ester, and ethyl isonitrosomalonate. Distillation of the green oil under diminished pressure gave, first, small amounts of acetic acid, various esters, crystalline ethyl dihydroxymalonate, and, finally, a good yield of ethyl oxomalonate. Ethyl dihydroxymalonate was obtained either by allowing the green oil to stand exposed to the air, when it took up moisture and passed to the dihydroxymalonate, or by adding water to the pure ethyl oxomalonate. The free mesoxalic acid was obtained by repeated extraction of the green oil with small portions of water. Evaporation of the aqueous extract in a vacuum desiccator gave good crystals of the acid. Contrary to Beilstein ethyl dihydroxymalonate is extremely soluble in water. It is easily soluble in ether, acetone, chloroform and absolute alcohol, slightly soluble in ligroin and insoluble in carbon disulphide. If the ethyl malonate is only partially saturated with nitrous anhydride, ethyl isonitrosomalonate is present in considerable amount. The crude reaction product was diluted with ether, washed with a little water, then with saturated sodium carbonate solution, then with water and finally dried and distilled at a low pressure. Alcoholic potassium hydroxide solution and ethyl isonitrosomalonate at  $-10^{\circ}$  gave a yellow precipitate of a potassium salt that gave good analytical figures. Other salts were obtained.

V. J. CHAMBERS.

**Isohexane and a New Dodecane.** BY LATHAM CLARKE AND R. MORRIS SHREVE. *Am. Ch. J.* **35**, 513-519.—Methylisobutyl carbinol was made by reducing methylisobutyl ketone, a small amount of methylisobutyl pinacone being formed at the same time. The ketone was dissolved in ether, mixed with about one-third volume of water, and treated with sodium in small pieces. Yield, nearly 70 per cent. of the theoretical. *Ethylisobutyl*.—The carbinol was dissolved in amyl alcohol, treated with hydriodic acid at 0° and then with glacial acetic acid and zinc. The action took place slowly on standing. *Methylisobutyl pinacone* was obtained from the high-boiling fraction of the product of the reduction of methylisobutyl ketone. It is a viscous oil, boiling-point 245°, with an odor like salt mackerel. It is soluble in organic solvents, but insoluble in water. Reduction of the pinacone in a similar manner gave methylisobutyl carbinol iodide, a colorless oily liquid boiling at 158-160° with some decomposition and *dimethylisobutylethane*, an oily liquid with a faint odor, soluble in ligroin, but slightly so in alcohol, boiling-point 208-210°.

V. J. CHAMBERS.

**On the Action of Chloride of Iodine on Pyrocatechol.** BY C. LORING JACKSON AND M. C. BOSWELL. *Am. Ch. J.* **35**, 519-531.—Pyrocatechol and iodine chloride reacted under various conditions giving red products evidently formed by the union of several molecules of pyrocatechol. Reduction of these substances by sulphur dioxide, after removal of the iodine, gave two white compounds, one melting at 224°, when a small proportion of the iodine chloride had been used (10:90 ICl), the other melting at 252°, formed by a larger amount (10:120 ICl). The substance melting at 224° may be octochlorotriiodopentapyrocatechol for the following reasons: Analysis indicates  $C_{30}H_{19}O_{10}Cl_8I_3$  or  $C_{26}H_{18}O_9Cl_7I_2$ , with the balance of evidence in favor of the first. Analysis of the acetyl derivative indicates the same. The compound must have two hydroxyl groups in the ortho position as oxidation with nitric acid gives a red substance melting at 272°, crystallizing with toluene of crystallization, and acted on by most solvents. This latter compound is probably an orthoquinone, perhaps the dark red first product of the action of iodine chloride on pyrocatechol. If the compound melting at 224° be reduced by sulphur dioxide before removing the iodine, trichloropyrocatechol is obtained. The substance melting at 252° gave analytical results agreeing with the formula  $C_{18}H_{10}O_6Cl_7I$ . Such a compound would be made up of three pyrocatechol molecules with part of the hydrogen replaced by halogen and might be called heptachloriodotripyrocatechol. Oxidation with nitric acid gave a red compound, probably an orthoquinone. Reduction with sulphur dioxide before removal of the iodine gave tetrachloropyrocatechol. The compound melting at 224° crystallizes from dilute alcohol in

long white, silky needles soluble in ether, benzene, or acetic acid. The one melting at 252° crystallizes from hot dilute alcohol in a similar form and is less soluble in alcohol or acetic acid than the one above.

V. J. CHAMBERS.

## BIOLOGICAL CHEMISTRY.

**The Influence of Temperature upon the Rate of Reaction (Haemolysis, Agglutination, Precipitation).** BY TH. MADSEN, H. NOGUCHI AND L. WALBUM. *J. Expt. Med.* 8, 337-365.—The experiments show that haemolysis, agglutination, and precipitation by a great many substances increase with increasing temperature, following the formula, which applies to other chemical phenomena:

$$\frac{C_1}{C_2} = \frac{\mu}{eR} \left( \frac{T_1 - T_2}{T_1 T_2} \right).$$

This is true for the haemolysis by the hydroxides of sodium, potassium and ammonia, by formic, acetic, propionic, butyric, maleic, citraconic, itaconic, oleic acids, by sodium oleate and by triolein, and furthermore by streptolysin and vibriolysin. It is true for the agglutination of the erythrocytes by ricin and mercuric chloride, for the precipitation of albumen by sulphuric acid and by specific precipitin; and also for the bacterial agglutination by the agglutinins of bacillus coli and bacillus typhosus. Still, the increase of the action with the temperature can only reach a certain limit, partly owing to the destruction of the medium (erythrocytes, bacteria), partly owing to the weakening of the active body itself (bacteriolysin, agglutinin). On the contrary, the tetanolysin showed peculiarities; for example, a maximum activity at 32°; staphylolysin showed a maximum activity between 20° and 30°, with lecithin and copra venom haemolysis at low and high temperature seems to proceed with about equal rapidity and to be more rapid than at the intermediate temperatures; the venom of the water moccasin acts most strongly at low temperatures.

F. P. UNDERHILL.

**The Toxicological Constitution of Amanita Phalloides.** BY WILLIAM W. FORD. *J. Expt. Med.* 8, 437-451.—From the experiments detailed in this paper it may be concluded that *Amanita phalloides* contains besides phallin, or the haemolytic principle of Kobert, another body of a toxic nature. Phallin is thermolabile, and is destroyed by the action of pepsin and pancreatin. The other toxic body is thermostable and is resistant to pepsin and pancreatin. The two substances, moreover, possess taxophoric and haptophoric groups, since an antiserum produced by the immunization of animals to the thermostable body has no neutralizing effects upon phallin. The thermolabile body,



phallin, produces the subcutaneous oedema and haemoglobinuria, and in virtue of its blood-lacking properties the pigmentation of the spleen. The thermostable body produces hemorrhage and necrosis, and the fatty degeneration of the parenchymatous organs. The two bodies exist side by side in watery extracts of the fungus, but they cannot be considered as two constituents of a single poison exerting a variety of effects. To the haemolysin the name phallin has been given by Kobert. For the thermostable substance described now for the first time, the name amanita-toxin is provisionally proposed.

F. P. UNDERHILL.

**The Glycylprolin Anhydride Obtained in Tryptic Digestion of Gelatine.** BY P. A. LEVENE AND W. A. BEATTY. *J. Expt. Med.* 8, 461-463.—Prolin is a primary constituent of the proteid molecule.

F. P. UNDERHILL.

**On the Phosphotungstates of Certain Amino Acids.** BY P. O. LEVENE AND W. A. BEATTY. *J. Expt. Med.* 8, 463-467.—Among the products of tryptic digestion of gelatin there have been isolated oxyprolin and an unknown body having the formula  $C_9H_{14}N_2O_8$ .

F. P. UNDERHILL.

**The Urine in Normal Pregnancy.** BY FRANK S. MATHEWS. *Am. J. Med. Sci.* 131, 1058-1061.—The pregnant woman during the fourth to the eighth month secretes rather more urine than the non-pregnant. The nitrogen elimination is diminished. Three hundred grains of urea (determined by the hypobromite method) is above the average toward the end of pregnancy. This is in part explained by the body's retention of nitrogen and perhaps in part by variations in the pregnant woman's diet.

F. P. UNDERHILL.

**The Enzymes of Phagocytic Cells of Inflammatory Exudates.** BY EUGENE L. OPIE. *J. Expt. Med.* 8, 410-437.—The exudates were obtained by the injection of aleuronate into the pleural cavities of the dogs. The presence of red blood cells seems to exert but an insignificant action upon the proteolysis by these exudates. The maximum digestion by the leucocytes from these exudates occurs in a slightly alkaline medium. Sulphuric and hydrochloric acids in the same strength (N/25) in which acetic acid favors digestion almost wholly prevent it, while in much weaker solutions they cause active digestion. The glycerol extract of the proteolytic enzymes of leucocytes diminishes in activity to a slight degree if kept a month. The powder prepared from leucocytes of a sterile exudate digests proteid actively in an almost neutral and in an alkaline medium, but has almost completely lost the power of the fresh cells to digest in an acid medium. The most probable explanation of this fact is that the leucocytes

of the exudates contain two ferments, one of which digests in a neutral or slightly alkaline medium, while the other acts in an acid medium; the former is uninjured during the process of preparing the dry powder while the latter is destroyed. The enzyme which acts in an alkaline medium has preserved its activity unchanged more than four months in the dry condition. Temperatures between  $55^{\circ}$  and  $70^{\circ}$  diminish the enzymotic activity of the fresh leucocytes exhibited in an acid medium but do not materially diminish proteolysis in an alkaline medium. The enzymotic power of fresh cells is destroyed at a temperature between  $70^{\circ}$  and  $75^{\circ}$ . During the progress of inflammation the ability of the cells to digest in an alkaline or neutral medium underwent little change, and their efficiency in an acid medium materially increased. With the progress of the inflammation there is an increase in the proportion of mononuclear cells and diminution in the percentage of polynuclear leucocytes, while corresponding with these changes there is a slight diminution of proteolysis in an alkaline medium and a well-marked increase in an acid medium. The proteolytic action of lymphatic glands containing larger mononuclear phagocytes which do not differ from those present in the exudate during the last stages of inflammation is exhibited in the presence of acid and is almost wholly absent in a neutral or alkaline medium. In the dried powder, prepared from washed leucocytes, a proteolytic enzyme digesting in a neutral or alkaline medium was found almost wholly free from activity in the presence of acid. The two enzymes have been called (1) leucoprotease, from the polynuclear leucocytes and (2) lymphoprotease, from the mononuclear phagocytes.

F. P. UNDERHILL.

**The Cause of the Heart Beat.** By W. H. HOWELL. *J. Am. Med. Assn.* 46, 1749-1753.—The heart possesses within itself a store of energy-yielding material, such that it may continue to give many hundreds or thousands of beats after its supply of nutriment has been cut off. Each contraction, whether caused normally or by any artificial stimulus, is maximal, and therefore probably uses up all the energy-yielding material which is in that moment in an irritable condition. The amount of this material in irritable form is nil during the phase of systole but increases in amount throughout the period of diastole. The store of energy-yielding material in the heart exists in some non-irritable form and during the phase of diastole a portion is converted into an irritable form capable of being acted upon by a stimulus. The presence of certain inorganic salts is necessary for this transformation from the non-irritable to the irritable condition.

F. P. UNDERHILL.

**A Study of the Relations of the Inorganic Salts of the Blood**

**to the Contractions of Heart Muscle and Skeletal Muscle.** By E. G. MARTIN. *Am. J. Physiol.* **16**, 191-221.—In connection with the question as to the nature of the inner stimulus for the ventricle, it is shown that a sodium chloride solution saturated with carbon dioxide stimulates freshly isolated strips of ventricle to immediate activity, differing in that respect from sodium chloride solution or sodium calcium mixtures, in that there is always a distinct latent period. This is interpreted as supporting the view that the "inner stimulus" for the ventricle is furnished by its metabolic products, one of which may be carbon dioxide, and as indicating that calcium ions have an indirect function rather than a directly stimulating one. In order to assign rôles to the blood salts in connection with the activity of the ventricle the hypothesis is advanced that reactions between the tissue substance and oxygen can take place only in the presence of diffusible calcium ions. The chief function of sodium ions is assumed to be that of causing by their mass action conversion of calcium tissue compounds from their normal form, in which the calcium is indiffusible, to one in which it is diffusible. The view that potassium ions are inhibitory only when present in diffusible combination is supported, and it is argued that in their normal tissue combinations they are indiffusible and so are not inhibitory. The high degree of rhythmicity exhibited by venous tissue is assumed to be due to the fact that in it calcium does not form an indiffusible tissue compound, hence is always available for use. Sodium ions are assumed to have the function in this tissue of maintaining favorable conditions for activity without themselves entering markedly into the contraction processes. The position is taken that the non-automaticity of skeletal muscle is a fundamental characteristic, and one to be taken into account when it is compared with the highly automatic heart muscle. It is shown that calcium ions favor the response of skeletal muscle to normal stimulation, just as they favor that of heart muscle to its "inner stimulus." The fibrillary twitches given by skeletal muscle in sodium chloride solution are assumed to be due to an irritation which is removed when a calcium salt is added. It is suggested that the action of diffusible calcium ions in promoting oxidation processes may be in the nature of the activation of enzymes. The assumption that sodium ions exert their influence through mass action is shown to be supported by the fact that sodium salts are effective only when present in quantity. It is suggested that diffusible potassium ions cause inhibition by forming inactive compounds with the zymogens of the tissue and with the contractile substances as well, thus interfering both with the oxidative reactions and with the process of contraction itself.

F. P. UNDERHILL.

**On the Cause of the Cessation of the Rhythm of Automatic**



**Tissues in Isotonic Solutions of Non-Electrolytes.** BY A. J. CARLSON. *Am. J. Physiol.* **16**, 221-230.—The duration of the maintenance of the activity of automatic tissues in isotonic solutions of non-electrolytes (sugar, urea, glycerol) depends on the condition of the automatic tissues and the specific nature of the non-electrolyte, and not directly on the rate of diffusion of the electrolytes of the plasma in the intracellular spaces into the solution of the non-electrolyte. It is, therefore, in part due to some action of the non-electrolyte on the automatic tissue. The cessation of the rhythm of the automatic heart tissue in solutions of non-electrolytes can therefore not be used as an argument in support of the view that the immediate cause of the rhythm of the automatic heart tissue is to be sought in the electrolytes of the plasma surrounding the tissue. F. P. UNDERHILL.

**The Physiological Action of Lanthanum, Praseodymium and Neodymium.** BY B. J. DREYFUSS AND C. G. R. WOLF. *Am. J. Physiol.* **61**, 314-324.—Equimolecular solutions of the chlorides of lanthanum, praseodymium and neodymium increase in toxicity with increasing molecular weight. It is probable that part of the acute effect observed is due to the hydrolysis of these salts, and to the consequent toxicity of the acid produced. It has not been possible to demonstrate a chronic condition of intoxication using moderate amounts of the salts.

F. P. UNDERHILL.

**Physiological and Pharmacological Studies of Magnesium Salts. III. The Narcotizing Effect of Magnesium Salts upon Nerve Fibers.** BY S. J. MELTZER AND JOHN AUER. *Am. J. Physiol.* **16**, 233-252.—Solutions of magnesium salts, even in strong concentrations, when directly applied to the nerve trunks of animals, never seemed to produce irritation. By application of solutions of magnesium salts to nerve trunks the conductivity can be interrupted, a more or less complete block for afferent and efferent for normal or artificial impulses can be established. This can be accomplished by hypotonic, isotonic, and hypertonic solutions. The more concentrated the solution the sooner the effect is established. In general it takes more time for the magnesium solutions to cause a nerve block than for other known local or general anaesthetics. The block produced in the nerves by the magnesium solutions disappears some time after removal of the solutions; the recovery of the nerve is greatly assisted by washing with Ringer's solution. The solutions of magnesium salts affect the cardiac fibres more readily than the efferent fibres for the oesophagus and the afferent respiratory and vasoconstrictor fibres within the vagus; also the sensory fibres within the sciatic nerve are more readily affected than the motor nerve fibres. It is believed that the difference is not due to a selective action of the

magnesium solutions upon the different nerve fibres but to a difference in the irritability of the nerve endings of these nerve fibres.

F. P. UNDERHILL.

**The Elimination of Creatinin.** BY OLIVER E. CLOSSON. *Am. J. Physiol.* **16**, 252-268.—The observations reported clearly indicate that creatinine is an unfailing constituent of the urine from an early period in man, the dog and the cat; and, independent of the ingestion of creatine and creatinine, it forms a characteristic endogenous, catabolic end-product. The experimental data contributed in this paper are in accord with observations of Folin and others in showing a fairly marked uniformity in the quantity of endogenous creatinine eliminated by any individual under variable conditions of diet. Furthermore, they are not at variance with Folin's opinion that the excreted creatinine is quantitatively dependent upon the mass of the active body tissues, and therefore, to a certain degree proportional to the body weight. A few records have been presented to indicate the rate of elimination of endogenous creatinine in contrast with that of the total nitrogen of the urine in brief periods; and a number of data afforded by exceptional cases have been discussed.

F. P. UNDERHILL.

**A Study of the Metabolism and Physiological Effects of Certain Phosphorus Compounds with Milch Cows.** BY W. H. JORDAN, E. B. HART AND A. J. PATTEN. *Am. J. Physiol.* **16**, 268-314.—The purpose of the investigations herein reported has been to study some of the nutritive relations and functions of the phosphorus compounds of cattle foods. The general plan was to feed foods poor and rich in phosphorus. The foods poor in phosphorus which were selected were rice, wheat gluten and oat straw, and the food rich in phosphorus selected was wheat bran having its phosphorus in organic combination in the form of phytin. The results show that the outgoing phosphorus rose and fell with the quantity supplied in the food, though within narrow limits. Through catabolic changes the phosphorus of the phytin and that of the unused digested nucleic bodies was reduced to inorganic combinations, and was excreted chiefly in the faeces, though to a small extent in the urine. Further evidence of catabolic metabolism of phosphorus compounds is found in the fact that the inorganic phosphates of the milk were from three to five times greater in quantity than the total amount of such compounds in the food. The rise and fall in the amounts of outgoing phosphorus compounds occurred almost wholly with the inorganic salts found in the egesta. The organic phosphorus bodies of the egesta were but little affected, if at all, by the proportions of phosphorus compounds in the food. Variations in the phosphorus supply appeared not to modify the appropria-

tion of this element by the milk. No relation whatever appears to exist between nitrogen excretion and phosphorus excretion.

F. P. UNDERHILL.

**The Stimulating and Inhibitory Effects of Magnesium and Calcium upon the Rhythmical Contractions of a Jellyfish (Polyorchis).** BY JACQUES LOEB. *J. Biol. Chem.* **1**, 427-437.—The experiments show that the normal rhythmical swimming motions of a jelly fish (polyorchis) will occur only in such solutions as contain magnesium, and that the apparently spontaneous character of these rhythmical motions depends upon the magnesium contained in the sea-water. This effect of magnesium can be inhibited by the addition of an equivalent amount of calcium or potassium. The isolated centre of polyorchis, which will not beat in a pure sugar solution or in sea-water, can be caused to beat in both solutions through the addition of a certain amount of calcium chloride (or strontium chloride or barium chloride) but not by magnesium chloride. Magnesium inhibits the stimulating effect of calcium when magnesium is added in the ratio of at least four times the equivalent of calcium. The isolated centre of polyorchis will, as a rule, not beat, or only after a number of hours in a pure sodium chloride solution, but it will beat instantly for from one to three hours when put into a solution of calcium chloride in cane-sugar. The isolated centre of polyorchis can be caused to beat by any of the decalcifying salts, *e. g.*, oxalates, fluorides, oleates, citrates, etc. Acids will cause the isolated centre of polyorchis to beat, while alkalis inhibit such heats.

F. P. UNDERHILL.

**The Determination of Small Quantities of Iron.** BY W. MCKIM MARRIOTT AND C. G. L. WOLF. *J. Biol. Chem.* **1**, 451-462.—This method is based upon the color-reaction which ferric salts undergo when treated with an alkaline thiocyanate. In the present paper acetone has been employed as the solvent and the method made applicable to various tissues and organic fluids such as blood and urine.

F. P. UNDERHILL.

**The Influence of Autolysis on the Pentose Content of the Pancreas.** BY PHILIP HENRY MITCHELL. *J. Biol. Chem.* **1**, 503-507.—No pentose is lost during prolonged autolysis in the absence of bacterial agencies. The pentose content of the pancreas is likewise not diminished by peptic digestion of the tissue.

F. P. UNDERHILL.

**On the Chemistry of Bacillus Coli Communis.** BY MARY F. LEACH. *J. Biol. Chem.* **1**, 463-503.—Elementary analyses show that age, conditions of growth, and especially the composition of the nutrient medium cause bacteria of the same strain to differ widely in elementary composition. Proteid, nucleoproteid,



nucleic acid, protamine, fat, wax, lecithin, glycogen, and other carbohydrates have all been reported as obtained from the bacterial cell in varying degrees of purity. Cellulose seems to be present in certain species, but by no means in all. Besides the preparations mentioned above, crystalline compounds have been prepared and purified, proving the presence in the cell of xanthine bases, pentoses, fatty acids, and perhaps thymine and uracil. Toxins, enzymes, and agglutinins have been split off from the cell; but more progress has been made in determining their physiological action than their chemical nature. The cell substance of *Bacillus coli communis* as prepared for this study, yielded about 8.5 per cent. of ash and 3 per cent. of phosphorus. Although it has been hardened by contact with alcohol, it is completely dissolved by successive treatment with dilute acid and dilute alkali. Heating with 1 per cent. sulphuric acid causes cleavage apparently along definite lines. The extract contains carbohydrate, muscle, phosphorized nitrogenous matter and bases, but neither proteid, protamine or nucleoproteid. The decomposition-products suggest that the cell is largely made up of nuclein or glyconucleoproteid; but even this dilute acid suffices to break off the carbohydrates, and to split up the proteid. Alcohol precipitates from this extract a hygroscopic toxic body, readily acted upon by the air when moist, apparently made up of sulphate, nucleic acid and color toxin. The alkaline extract contains carbohydrate, and a nucleo compound. No evidence of cellulose was found. By digestion with stronger acid, xanthine and hexone bases were obtained; lysine was isolated as picrate, purified and transformed into the chloride, and proved to be identical with lysine picrate and chloride from other sources.

F. P. UNDERHILL.

### **Studies in the Chemistry of the Ion-Proteid Compounds. III. On the Influence of Electrolytes upon the Toxicity of Alkaloids.**

By T. BRAILSFORD ROBERTSON. *J. Biol. Chem.* 1, 507-558.—The influence of various salts upon the toxicity of fourteen alkaloids for *paramoecium*, *tubifex* and *gammarus*, and the influence of salts upon the action of veratrine upon striated muscle have been investigated. The various salts exert a distinct and definite action upon the toxicity of the alkaloids investigated. The effects observed are not due entirely to alterations in permeability or to the influence of hydrions or hydroxidions set free by hydrolytic dissociation of the salts. The results are such as to lend support to the hypothesis of the existence of an unstable ion compound in protoplasm, the ion of which is readily replaced by other ions, the ion which is present in the greater mass forming the greater part of the compound, the acid or basic properties of which depend upon the acid or basic properties of the ion in the compound. Certain instances were found in which the toxicity

of a salt was diminished by the addition of the alkaloid, while the same alkaloid in the same concentration increased the toxicity of other salts. These cases may possibly be attributed to the alkaloid removing or neutralizing a toxic ion by combining with the ion-proteid which it forms. Possible applications to special physiological investigation and to therapeutics have been indicated.

F. P. UNDERHILL.

## PHARMACEUTICAL CHEMISTRY.

**American Pharmacopoeia.** BY SCHIMMEL & CO. *Am. J. Pharm.* 78, 253-262 (1906).—The authors' preliminary comments are quite complimentary to the committee of revision, especially that part of the committee having in charge the essential oils. However, they take exceptions to some of the requirements. They have determined the difference existing between the specific gravity taken at 15/15 and at 25/25 for all U. S. P. volatile oils, and find the average difference to be 0.00064 for each degree of temperature. Their exact results are given in tabulated form. In many cases the results found for 25/25, based on their standard at 15/15 is found to give a wider limit than that given by the U. S. P.; e. g., bitter almond oil, U. S. P. requires sp. gr. 1.045 to 1.060; found by authors to be 1.038 to 1.063. The authors were unable to obtain satisfactory results with the pharmacopoeial sulphite method for determining benzaldehyde, and doubt its usefulness. They make the following comments upon individual oils. Bitter almond oil requires 1 to 2 volumes of 70 per cent. alcohol for solution instead of an equal volume. The method for the estimation of cineol in cajeput and eucalyptus oils gives only approximate results. Cinnamic aldehyde is not colorless but bright yellow. Copaiba oil requires 5 to 10 volumes of 95 per cent. alcohol for solution instead of 2 volumes. The method for the determination of citral is unreliable. The specific gravity of nutmeg oil should be increased to 0.924, otherwise the best oil will be excluded. The requirements for oil of rosemary are too high. Good oil may contain as low as 1.2 per cent. of ester and 10 per cent. of total borneol. In the estimation of santalol the results should be based on the formula  $C_{15}H_{24}O$  instead of  $C_{15}H_{26}O$ . Good sassafras oil may require 1 to 2 volumes of 90 per cent. alcohol for solution.

A. B. STEVENS.

**Assay of Opium and Its Preparations.** BY PHILIP ASHER. *Am. J. Pharm.* 78, 262 (1906).—The author has slightly modified the method of A. B. Stevens, *Pharm. Archives* 5, 41 (1902). The modification consists principally in mixing the opium with 5 cc. of 5 per cent. potassium hydroxide solution and evaporating to dryness, before adding the lime. The author claims that this preliminary treatment more completely removes the ammonia

which is liberated by the alkali, thus preventing the precipitation of the morphine in the original solution. Therefore, he obtained a larger yield of morphine than he was able to obtain by the original method.

A. B. STEVENS.

**Syrup of Wild Cherry, U. S. P., 1900.** BY JOSEPH W. ENGLAND. *Am. J. Pharm.* 78, 267 (1906).—The author reviews the methods that have been official since 1850, and criticizes the method of 1900. He assumes that because the volume of menstruum has been reduced by omitting the glycerol until after percolation, that the drug is not exhausted. Also that the addition of glycerol to the menstruum tends to prevent fermentation during percolation. He states that the syrup made by the new method is amber-colored and of an insipid taste, while that made by the old method was ruby-red and more astringent. He concludes that the new formula is inferior to the old, but has failed to prove that such is the case.

A. B. STEVENS.

**Progress in Pharmacy.** BY M. I. WILBERT. *Am. J. Pharm.* 78, 280-284 (1906).—The author states that not less than 200 pharmacists and 800 physicians were rendered homeless and practically penniless by the San Francisco diaster. He also notes the publication of the "Nederlandsche Pharmacopee." The principal features are: Atomic weights, based on O=16. General adoption of formulas recommended by the International Conference, introduction of numerous tests, which include determination of melting-point, boiling-point, iodine and saponification numbers for fatty oils, and microscopical examination of powdered drugs, manufacture of aromatic waters by distillation, aqueous extracts by maceration or infusion and alcoholic extracts by percolation. The appendix contains a chapter on first aid to the injured and another on antidotes for poisons.

A. B. STEVENS.

The following test for the "Detection of Small Traces of Copper in Distilled Water" is taken from the *Pharm. J.* 1906, p. 387. "Add 2 drops of ammonia to 500 cc. of the suspected water and filter three or four times through a plug of cotton wool." The cotton will be colored pale green if there is a trace of copper present.

A. B. STEVENS.

## INDUSTRIAL CHEMISTRY.

**The Keeping of Tobacco.** BY JAMES M. BELL. *Science*, June 15, 1906, 904-912.—The problem of having the desired amount of moisture in tobacco has several requirements dictated by the trade.

That of keeping filler and wrapper tobacco of the proper degree of moisture; keeping cigars at a somewhat different degree of



moisture, and also that of rendering stock of tobacco and cigars more moist or less so by a perfectly automatic means. The method is to keep them in the same container with a quantity of some salt, the vapor-pressure of whose saturated solution is just that of the tobacco when in the desired state of moisture content.

Experimentally, the vapor-pressure for cigars was found with solutions of sulphuric acid, and then from Lescoeur's tables a salt was selected that would keep the balance, as sulphuric acid would lose strength. Barium bromide ( $\text{BaBr}_2 \cdot 2\text{H}_2\text{O}$ ) was selected for the plug cut tobacco used. Since the first experiments carried out at Cornell University under Dr. Bancroft, the author, working for the Department of Agriculture, has established a series of salts for different tobaccos. For cigars and cigar stock, salts with higher vapor pressures were used than for the plug cut tobacco, which required 10.8 mm. at  $20^\circ\text{C}$ . The cigar grades run about 15 mm., ammonium sulphate (14.8) and potassium nitrate (15.0) being most available.

S. S. SADTLER.

**An Endurance Test of a Gas Producer.** *Editorial Am. Gas-light J.* May 14, 1906, 848-849.—This relates to a continuous run of twenty-four days, with bituminous coal, made by the Geological Survey. The coal used had the following analysis: Moisture 14.86 per cent., volatile combustible matter 30.98 per cent., fixed carbon, ash, 11.41 per cent., heating value, 12,343 B. T. U.

The plant used consisted of a Taylor pressure-producer of 250 horse-power, a vertical 3-cylinder single-acting Westinghouse gas engine of 235 brake horse-power capacity, a 175 Westinghouse generator, with the current absorbed by a water rheostat.

About 150 pounds of coal were charged in 3-inch egg size every twenty-five to thirty minutes.

The gas left the generator at about  $644^\circ\text{F}$ . and went first to a water-seal dust collector, then to the scrubber, then to the centrifugal tar extractor and then to the gas-holder.

Calorimetric tests of the heating value of the gas were made every twenty minutes, and volumetric analyses every two hours. The average value of the gas was 156.1 B. T. U. per cubic foot. It contained no hydrogen sulphide, 9.2 per cent. carbon dioxide, no oxygen, 0.4 per cent. ethylene, 20.9 per cent. carbon monoxide, 15.6 per cent. hydrogen, 1.9 per cent. methane and 32 per cent. nitrogen.

Forty-three pounds of coal-tar were obtained from every ton of coal used. The accumulation of this tar caused the cessation of the run, as the gas passages were too tortuous.

The engine and producer were found to be in good order at the end of the run.

S. S. SADTLER.

**The Chemistry of Electric Lamps.** *Electrochem. Met. Ind.* June, 1906, 205-206.—The discovery and development of the

incandescent electric lamp has been and is dependent upon chemical engineering. Since the original work of Edison, there have recently been brought out the osmium lamp of Welsbach, the tantalum lamp of Siemens and Halske, the graphitized filament lamp of the General Electric Company, and very recently the tungsten lamp of Dr. Kuzel and others. A zirconium lamp is also promised.

The work with the rare elements has been very largely pioneer work as, to get the requisite high melting-points, the metals must be as pure as possible. In the case of the latest lamp, the Kuzel lamp, the filament is formed by first getting the metal in the colloidal state, in which it is an electrolytic conductor, and then by heating it is converted into a conductor of the first class, a metallic conductor.

S. S. SADTLER.

**Boiler Waters and Their Treatment.** BY WILLIAM H. BOOTH, B.S. *Chem. Eng.* April, 1906, 359-367.—The accuracy of the permanganate method of estimating calcium salts in water is checked up in some particulars, and it is found that the temperature and dilution of the sulphuric acid are important factors.

With reference to the softening of waters for small boilers, there are various ways of introducing chemicals into a boiler. A good way is to use a little concentrated solution. This can be drawn in with the feed water on the suction side of the feed pump, by being allowed to drop into the feed water tank at a measured rate.

The prevention of scale is generally effected with much less than the theoretical amount of softener. Blowing off the boilers two or three times daily is very effective for preventing scale. A great deal of the difficulty with foaming is due to oil in the returned feed water, rather than the use of soda ash, which does not cause foaming when used in proper amounts.

S. S. SADTLER.

**The Valuation of Portland Cement.** *Chem. Eng.* April, 1906, 374-384.—

*Normal Consistency* is found by means of a *Vicat needle*, which penetrates a certain distance with a given weight, and both the initial set and the final set are determined with it. A less exact, but much used practical test, is made by making balls of the neat cement, and dropping to a table from a height of 18 inches. If too much water has been used, the balls flatten, or if too little they crack. The proper amount of water for sand mortar is found by means of a table.

*Setting time* is also determined by the *Vicat needle*, by noting when it only sinks a certain distance and when it does not sink at all.

*Soundness* is determined by making pats with thin edges and

putting them in a moist closet for twenty-four hours, then treating with steam for three hours, also by soaking in water for twenty-eight days. With none of these tests should there be any cracking, distortion or disintegration.

*Tensile strength* is determined by making briquettes of definite consistency, either neat or mortar, and determining the strength by pulling-in machines made for the purpose. They are soaked before pulling, for seven or twenty-eight days, three, six, nine or twelve months, one to ten years, etc.

S. S. SADTLER.

**The American Chemist and the Gas Industry.** By H. B. HARROP, M.D., B.S. *Chem. Eng.* April, 1906, 385.—The following are matters of importance to the gas industry:

(1) How much heat in B. T. U. is required to carbonize one pound of coal, yielding coke and gas as in ordinary practice? (This is a quantity that must be determined before we can know anything about the ideal we are trying to reach in the design and operation of oven and retort furnaces.)

(2) Theory of producer gas and water gas manufacturer, and an indication of the lines along which development must proceed to reach greater efficiency.

(3) Heat conductivity of fire-brick, of iron, and of the various heat insulating coverings. (There are some detached data on these subjects, but the information is incomplete and indefinite. Regarding iron, especially, the published figures usually fail to state whether heat is exchanged between iron and air, iron and water, whether water is flowing or quiescent, etc., etc.)

(4) Reliable data on the heats of combustion of various combustible substances—solid, liquid and gaseous.

(5) Reliable data on the specific heats of gases at all temperatures that occur in ordinary work.

(6) Data on flame temperatures.

(7) Is the temperature of a flame raised by pre-heating its components or does dissociation set a definite limit to the temperature by effecting a slower or "delayed" combustion?

(8) Theory of flames, of flame luminosity, of enrichers. (The explanation of flame luminosity may be a simple function of the temperature and the composition of the illuminant, but this is hardly settled.)

(9) What are the relative effects, quantitatively, of the presence of different percentages of  $\text{CO}_2$ ,  $\text{O}_2$  and  $\text{N}_2$  on flame luminosity?

(10) Is the amount of light that may be obtained from a given Welsbach mantle strictly dependent on the calorific power of the gas used?

(11) Theory of the inductor, or that part of the Welsbach lamp which aspirates air into the Bunsen mixer.

(12) Theory of Bunsen and blast flames.



(13) Relative percentages of  $\text{SO}_2$  and  $\text{SO}_3$  formed by combustion of sulphur compounds in burning gas.

(14) Relation of tar extraction from gas to removal of illuminants and naphthalene.

(15) Theory of washing and scrubbing gas and effect on illuminants,  $\text{CO}_2$ ,  $\text{H}_2\text{S}$  and  $\text{CS}_2$ .

(16) Determination of  $\text{C}_2\text{H}_4$  and its homologues in gas analysis.

(19) Effect of potassium hydroxide on benzene in gas analysis; of cuprous chloride solution on illuminants; relative value of absorption by bromine and fuming sulphuric acid.

(20) Relation of specific gravity of coal to value.

(21) Systematic analysis and mapping of all American coals suitable for gas-making.

(22) Blending of different coals to produce grades of coke wanted.

(23) Formation and behavior of iron carbonyl.

(24) Specifications for open flame and incandescent burners.

In addition to these are lines of commercial value. These suggestions refer to:

A more efficient method of carbonizing, such as a vertical retort. It is especially hoped that greater efficiency in the production and recovery of ammonia may be obtained.

A practical method of quenching incandescent coke, so as to leave as little moisture as possible in the same, and, if possible, to recover the most of the heat.

The recovery of cyanogen as the alkali salts of hydrocyanic acid.

A simple process of making anhydrous ammonia, so as to avoid the storage and transportation of the crude liquor.

A suitable method of desiccating or drying gas before distribution, so as to avoid the accumulation of frost in pipes.

An efficient gas producer that will use bituminous coal without the recovery of by-products.

The discovery of a more efficient lighting appliance, so that more than 5 per cent. of the total heat energy, as obtained by the Auer mixture, may be obtained.

S. S. SADTLER.

**The Elements of Chemical Engineering.** *Chem. Eng.* May, 1906, 24-31.—

*Bins.*—The main consideration in the construction of bins is the settling upon the "angle of natural slope" or "angle of repose." The way of approximately finding this is shown by means of a diagram. This enables the engineer to calculate the pressure on the sides, and to decide upon the amount of material that would either be inert in the bin, or the slope at which the floor could be built, so as to avoid the carrying of any excess of material.

Various forms of gate may be used, it being desirable, however,

in many cases, to use a mechanical form of regulating ejector, so that definite amounts of material can be removed.

S. S. SADTLER.

**A Recording Calorimeter for Gas. The Relation of Flame Temperature to Calorific Power.** BY J. WATSON BAIN, B.A., SC. AND J. W. BATTEN. *J. Chem. Ind.* June 15, 1906, 505-507.—The LeChatelier thermo-couple was used for determining the flame temperatures of gas used in the experiments.

Determinations of the calorimetric power and flame temperature were made every three minutes, and results plotted, with the result that it was shown that there is a direct relationship of flame temperature and calorific pressure.

S. S. SADTLER.

**Composition and Properties of Cotton Softeners.** BY F. E. BURNHAM. *J. Chem. Ind.* April 16, 1906, 295-296.—The preparations used for cotton softening must contain a solution of soap and an oil. There may be other materials used in proprietary preparations, but those mentioned give the desired properties to the preparations.

The soap may be either a potash soap or a soda soap. The potash soaps tend to greater softness, but require the use of solid fats, such as tallow or lard, and this grade of preparation is, of course, more expensive.

With the use of the soda soap, the free oil should be olive or maize oil.

Typical analyses of the soda and potash softeners are as follows:

SODA SOFTENER.		POTASH SOFTENER.	
Water .....	64.2	Water .....	68.4
Oil .....	9.0	Oil .....	7.9
Dry soap.....	26.8	Soap.....	23.7

In addition to the constituents mentioned, glycerol is somewhat used for its hygroscopicity, it being either added, or coming from the direct saponification of the oil. Where the latter method is used, the oil must be in excess so that there is sufficient left over that has not gone into the formation of the soap.

A cotton softener which is largely used is of somewhat different composition from those just mentioned, it being sulphuricinoleic acid or Turkey red oil, but this has no advantage to compensate for the higher price.

S. S. SADTLER.

**Earth Alkali and Applied Peroxides; Properties and Applications.** BY R. VON FOREGGER AND H. PHILIPP. *J. Chem. Ind.* April 16, 1906, 298-302.—The explanation for the action of the earth alkaline peroxides is to be had in the supposition that one atom is tetravalent.

*Calcium Peroxide*,  $\text{CaO}_2 \cdot 8\text{H}_2\text{O}$ .—This product is obtained by the action of hydrogen peroxide on lime-water. It occurs in loose,

needle-like crystals, but as specially prepared for industrial purposes, it is free from molecular water, and has the form of a fine, yellowish white powder.

A third hydrate containing 2 molecules of water is known. The dehydrated product as ordinarily prepared contains 60 per cent. of true peroxide, with  $13\frac{1}{2}$  per cent. available oxygen, but has been obtained with as high as 80 per cent. peroxide and 17.8 per cent. available oxygen.

One part of peroxide dissolves in 7.025 parts of water at  $20^{\circ}$ . A distinction is possible between the simple solubility in water and dissociation. There is more dissociated oxygen found in the solution than the solubility of the product warrants. This active oxygen, furthermore, is stable even at boiling temperature, therefore, not in the form of free hydrogen peroxide. It is supposed that the calcium peroxide when added to water forms a compound with 2 molecules of water, which then undergoes a molecular change as follows:

$\text{CaO}_2, 2\text{H}_2\text{O} = \text{Ca}(\text{OH})_2, \text{H}_2\text{O}_2$ . In a dry atmosphere, the peroxide is sufficiently stable to stand heating to a temperature of  $200^{\circ}$ .

Calcium peroxide is practically non-explosive, for when it is mixed with animal charcoal in equal parts and detonated, no explosion takes place.

*Strontium peroxide*, which has the symbol  $\text{SrO}_2, 8\text{H}_2\text{O}$  when crystallized. As it occurs in commerce after it is dehydrated, it contains 85 per cent.  $\text{SrO}_2$ , the balance being strontium hydroxide. Its solubility, calculated on the amount on strontium, is one part in 12,500 parts of water at  $29^{\circ}$ . Its capability of dissociating its oxygen is greater than that of calcium peroxide.

This peroxide is similarly quite stable in a dry atmosphere, it being possible to heat it to  $150^{\circ}$  without loss of available oxygen.

*Magnesium Peroxide*.—This is an amorphous white powder, and is supposed to be a perhydroxide of magnesium. This is soluble in 14,550 parts of water at  $20^{\circ}$ . When suspended in water, it dissociates its available oxygen quicker than zinc peroxide and slower than calcium or strontium peroxides, but it loses its available oxygen quicker in moist atmospheres than the other peroxides, it being apparently more subject to the influence of carbon dioxide.

*Zinc Peroxide*.—This peroxide occurs in anhydrous form, there being no hydrates. It contains about 50 per cent. of zinc peroxide. It is a dense yellowish-white powder of specific gravity 1.571, the peroxides of calcium and strontium being considerably lighter than water. This peroxide is very stable, not losing its available oxygen when heated to  $170^{\circ}$  in dry air. At a temperature of  $100^{\circ}$  the moisture evaporates without affecting the product itself.

Zinc peroxide is very permanent in water and very slightly soluble, the oxidizing action being obtained by means of acids.



It is used in surgery and dermatology as an antiseptic, it being odorless and non-irritant.

These peroxides are used for bleaching oils and as antiseptics and disinfectants, the main benefit in their use being the powerful action and the fact that the residues after that action are either inert or have basic qualities. Where they are used as antiseptics in wines, fruit products and waters, the calcium or other oxides that remain are non-deleterious. Where zinc is used the zinc oxide has valuable properties after the peroxide has been decomposed.

S. S. SADTLER.

**Chimney Draughting and Connecting Flues in Chemical Works.** BY HERBERT PORTER. *Chem. Eng.* May, 1906, pp. 16-22. —One of the principal points in chimney construction is the undoubted fact that there is a layer of quiescent gas in contact with the walls of the chimney. This cuts down the actual capacity of the chimney and serves the important function of acting as a continuous roller-bearing, and thereby reduces the friction.

It should be borne in mind that a flue should rather decrease in size toward the chimney than increase, as when a gas cools, the speed of movement would be cut down, if the space were not made smaller. A very cool gas entering a larger volume of hot gas may even decrease the total volume of the gas rather than increase it, due to the chilling action.

Lateral openings in larger flues should be inclined at an angle and not inserted at right angles, the smaller pipe projecting a small distance into the main flue. Where two flues of the same cross-section join, the division wall should be carried an appreciable distance from the actual junction of the two flues.

It is important that cold gas should not be made to go up hill or hot gas down hill.

S. S. SADTLER.

**Standardizing Rubber-covered Wires and Cables.** BY JOHN LANGAN. *Proc. Am. Inst. Elec. Eng.* 25, 189 (1906). —At the present time rubber-covered wires and cables are bought and sold under the National Code or Board of Fire Underwriters' Rules, both of which impose no provision as to the quality of the covering. The rubber must be vulcanized, *i. e.*, treated with sulphur and heated, in order to make a proper insulating material or it will disintegrate under the influence of air and moisture and become worthless, no matter how fine the quality at first. Para contains the least resinous matter of any (1 per cent.) and is consequently the best. Properly vulcanized insulation should stand a rigid stretching test and should not contain more than 32 per cent. of rubber on chemical examination, as a large percentage (40-50 per cent.) of very poor rubber in the insulation combined with (10-15 per cent.) of para will give a high test-covering but one which will not wear. The resin content must be

below 5 per cent. in order to allow of differentiation of the various grades of rubber by the chemist. A higher percentage of resin is to be regarded as suspicious and showing adulteration. Specifications for rubber insulated wires and cables are given, together with detailed methods for making various physical tests of a mechanical or electrical nature, with their advantages and disadvantages.

R. C. SNOWDON.

### AGRICULTURAL CHEMISTRY.

**The Absorption of Phosphates by Soils.** BY OSWALD SCHREINER AND GEORGE H. FAILYER. *J. Physic. Chem.* April, 1906.—The article is a detailed statement of the work upon this subject, reported in Bulletin No. 32, Bureau of Soils, which was recently reviewed in this Journal.

J. H. PETTIT.

**The Effect of Fertilizers on the Reaction of Soils.** BY F. P. VEITCH. *Science*, May 4, 1906.—Upon soils from the Experiment Station Farm at Wooster, Ohio, which have been under treatment since 1894, the use of such fertilizers as acid phosphate, potassium chloride and farm manure has not increased the acidity. Basic slag and sodium nitrate have decreased the acidity, while ammonium sulphate alone has increased it.

J. H. PETTIT.

**1. Fertilizer Tests with Wheat and Corn. 2. The Loss of Nitrogen from Soils.** BY HARRY SNYDER. *Bull. 94, Minn. Agr. Expt. Sta.*—The first part of the Bulletin gives the result of one year's coöperative work upon different soils over the State. With wheat, nitrogen did not give an economical increase and in only a few cases was the use of the mineral elements profitable. Farm manure, used in several instances, improved the yield. Nitrogen, however, had some effect toward increasing the protein content of the wheat. With corn, potassium alone gave the most noticeable increase in yield. The author states "it is impossible to draw definite conclusions from trials of one season only, but the results, taken as a whole, indicate that it is not feasible, by the use of commercial fertilizers alone, to economically restore fertility to soils that have been impoverished by exclusive grain farming." The second part of the Bulletin shows the change in nitrogen content of several soils, brought about by different systems of farming over a period of ten years. Samples were taken in 1895 and again ten years later. The loss of nitrogen from four grain farms was from three to five times more than that removed in the crops, while the use of a rotation, in which clover was grown, and the practice of a live-stock system of farming practically maintained the nitrogen content.

J. H. PETTIT.

**Fertilizer Experiments with Sugar Beets.** BY A. H.

DANIELSON. *Bull. 115, Colo. Agr. Expt. Sta.*—Nitrogen in the form of sodium nitrate is the only plant food that has materially increased profits. Lime was without effect. Colorado soils generally contain ample supplies of potash, phosphoric acid and lime but are somewhat deficient in nitrogen and humus.

F. P. VEITCH.

**The Sources of the Nitrogen of Vegetation.** *West Indian Bull. 7, No. 1, 1906, 95.*—A brief general resumé, followed by a description of the experiments conducted at Rothamsted on the fixation of nitrogen, the description being taken from the book of the Rothamsted experiments by A. D. Hall.

F. P. VEITCH.

**Commercial Fertilizers.** BY J. L. MILLS AND C. H. JONES. *Bull. 123, Vermont Agr. Expt. Sta.*—In addition to tabulated analyses of 130 brands of fertilizers and comparative analyses for the past five years, the subject of fertilizers is discussed quite fully with reference to the quantity, quality, selling price and valuations of brands offered in the State, and suggestions are made as to the purchase of fertilizers in order to secure the greatest values for the money. A valuable feature of the bulletin is a popular discussion of "The Moisture Relations of the Soil and the Control and Effect of Such Relations on Crop Production."

F. P. VEITCH.

**Tabulated Analyses of Commercial Fertilizers.** *Bull. 142, Penn. Dept. Agr.*—The analyses of 450 samples collected from August 1, 1905, to December 31, 1905, are given.

F. P. VEITCH.

**Report of Analyses of Samples of Fertilizers Collected by the Commissioner of Agriculture during 1905.** *Bull. 272, New York Agr. Expt. Sta.*

F. P. VEITCH.

**Commercial Fertilizers.** BY M. A. SCOVELL, ET AL. *Bull. 123, Ky. Agr. Expt. Sta.*—Analyses of 151 samples collected in the latter part of 1905.

F. P. VEITCH.

**Standard Fertilizers, 1906.** BY THOMAS MCFARLANE. *Bull. 118, Laboratory Inland Revenue Department, Ottawa, Canada.*—This bulletin contains the tabulated analyses of 153 samples of fertilizers offered for sale in Canada.

F. P. VEITCH.

**Report of the Referee for 1905.** BY H. C. REED. *Journal American Leather Chemists' Association, 1, (1906) No. 1.*—The initial number of this journal devoted to the chemistry of the manufacture of leather is entirely taken up with the report of the referee which has already been abstracted in this review from another source. See this Journal, 28, 115 (1906).

F. P. VEITCH.



**Report on the Tanning Materials and Manufacture of Leather in Jamaica.** BY M. NIERENSTEIN. *Bull. Dept. Agric., Jamaica*, 4, (1906) No. 6, 121.—*Acacia catechu*, "butterfly tree," *Bauhinia variegata*, *divi divi*, *Caesalpinia coriacea*, white mangrove, *Loguncularia racemosa* occur in the island and are used to a slight extent in the manufacture of leather, about 31 tons of which are produced annually in 21 tanneries. It is suggested that an extract from white mangrove would be suitable for tanning light leathers.

F. P. VEITCH.

**Mineral Constituents in Tanning Materials.** BY J. L. VAN GYN.—The author gives the following figures as the average obtained on a number of authentic samples:

	Total ash. Per cent. of sample.	SiO <sub>2</sub> . Per cent. (sand).	CaO of ash (lime).	Iron per 1000 parts of ash.
Oak Bark—English .....	5.6	3.0	52.2	6.60
Belgian.....	5.1	2.1	55.2	2.62
Dutch.....	5.3	1.7	47.8	1.325
Valonia—Greek beard.....	5.04	57.74	12.66	17.9
Greek cup.....	2.6	10.8	23.5	17.45
Smyrna, mixed.....	4.99	64.9	15.3	17.3
Myrabolams .....	2.67	1.48	20.73	3.35
Algarobilla .....	2.06	28.60	9.2	11.1
Gambier.....	3.9	18.4	15.0	7.46
Mimosa bark.....	2.6	5.6	21.7	10.6
Hemlock bark.....	1.8	6.8	53.9	22.6
Mallet bark.....	3.6	1.28	50.9	1.63
Sumach.....	6.9	20.4	61.5	15.47
German pine bark.....	2.6	2.5	49.5	0.5
Oakwood extract.....	0.88	4.6	35.71	30.5
French chestnut extract.....	2.10	4.0	10.8	5.35
American chestnut oak extract..	1.1	4.9	60.23	14.8
Quebracho extract.....	1.2	9.23	39.66	3.6
Quebracho decolorized.....	6.2	5.2	13.75	1.75
"Tannadine" .....	1.1	2.0	29.33	2.5

F. P. VEITCH.

**Rosin Size Analysis.** BY BEADLE AND STEVENS. *Wood Pulp News*, 29, No. 213 (1906).—The authors have tested several methods for estimating water in rosin size, (1) by distilling the water and turpentine and measuring the volume, (2) by weighing the residue from (1) and calculating the loss, (3) by direct drying of the size, and (4) by difference. The extreme difference between these methods is 1.09 per cent.

F. P. VEITCH.

**Resin in Pulp.** BY W. HERSBERG. *Abs. in the Paper Mill and Wood Pulp News*, 19, No. 28 (1906) 2.—The average analysis of a number of samples gave the following figures for resin content of different pulps. Mitscherlich bleached 0.44 per cent., unbleached 0.58 per cent, Ritter-Kellner bleached 0.45 per cent., unbleached 0.59 per cent., bisulphite bleached 0.42 per cent., unbleached 0.72 per cent., soda bleached 0.03 per cent., unbleached 0.04 per cent.

F. P. VEITCH.

**Casein and Its Use.** BY A. WEICHETT. *Papier Ztg.*, Abs. in the *Paper Mill*, 19, No. 28 (1906), 32.—A general discussion of the preparation of casein and the importance of using neutral solutions in mixing with colors. A number of formulas for the preparation of paper coatings are given. F. P. VEITCH.

**Director's Report.** BY W. H. JORDAN. *N. Y. Agr. Expt. Sta. Bull.* 274.—This bulletin gives among other things a report of Bulletin 261 of this station on the "Relations of Casein and Paracasein to Bases and Acids and their Application to Cheddar Cheese," in which it was shown that casein exists in milk as a calcium compound, which compound when treated with acids becomes free casein, soluble in 5 per cent. salt solution and in hot 50 per cent. alcohol. When free casein is treated with acids a casein salt of the acid is formed, called casein lactate, better known as the curd of curdled milk. In cheese-making, the curd formed by the use of rennet is calcium paracasein, which under the action of the acid produced in the process, becomes free paracasein, the compound which forms the starting point of the various changes that take place in the ripening process of cheese. "The Proteids of Butter in Relation to Mottled Butter" is the title of Bulletin 263 reported here in which the occurrence of white streaks or spots on butter was studied. The presence of buttermilk in butter was found necessary for the production of these spots. When buttermilk was entirely removed, the cause of the white spots disappeared. The casein lactate in the buttermilk, in contact with salt, produced the white spots. "Plant Food Constituents Used By Bearing Fruit Trees." This report touches upon the work of Bulletin 265, as per above title, in which the amounts of nitrogen, phosphoric acid, potash, lime and magnesia taken up by the growing trees during one season were determined. The fruit, leaves, and the new growth of wood produced during the year were separated and weighed and the above constituents determined in them. From the results of analyses it was found that the peach tree used up the most plant food, the apple, quince, pear and plum following in the order named.

J. A. LECLERC.

**Fifteenth Annual Report Agricultural Experiment Station of Wyoming.**—In the chemist's report is found a short resumé of "Forage Plant Investigations," which contains tables of the chemical composition of the native grasses, rushes and sedges of that state. (This appeared in Bulletin 65, already abstracted.) Likewise is found a summary of "Digestion Experiments with Forage Plants" in which it is shown that the second growth alfalfa grown under conditions prevailing in Wyoming is more digestible than first growth alfalfa grown and cured at low altitudes under humid conditions. On page 61 of the report F. E. Hepner has

published "Tables for Use in Nitrogen and Protein Determinations" applicable to the Kjeldahl and Gunning methods. The tables are based on the use of N/2 or N/5 acid and N/10 alkali.

J. A. LECLERC.

**Concentrated By-Products for Poultry Feeding.** BY W. P. WHEELER. *N. Y. Agr. Expt. Sta. Bull.* 271.—This bulletin reports experiments on the feeding of concentrated by-products, such as meat, bone- and blood-meal, milk albumen, etc., so as to supply the poultry the requisite amount of protein and mineral matter. The poorest ration was deficient in mineral matter; the most profitable was one containing animal meal. The milk albumen was palatable and superior to animal meal, but more costly. Tables giving the chemical composition of the various feeds, the amounts fed, the cost of the feed per pound of live weight, etc., are inserted.

J. A. LECLERC.

**Alfalfa.** BY WILLIAM P. HEADDEN. *Colo. Agr. Expt. Sta. Bull.* 111.—This is a synopsis of Bulletin 35, issued in 1896, and besides containing an index of Bulletin 35, it also gives the results in brief. Alfalfa originated in Media and was introduced into Colorado in the sixties. There is no difference in chemical composition of this plant, whether dried in air, or at 100°. The first cutting contained 14.9 per cent. proteid, the second 14 per cent., the third 13.5 per cent. A comparison of the normal alfalfa hay with hay that had been damaged by rain follows:

	Normal.	Damaged.
Ash .....	12.13	12.71
Fat .....	3.94	3.81
Protein .....	18.71	11.01
Fiber .....	26.46	38.83
Nitrogen-free extract .....	38.71	33.64

The protein content is almost stationary from the beginning to half bloom; after full bloom it decreases. The percentage of crude fiber increases with the age of the plant. The percentage of ash varies but little in the different cuttings. The percentage of water varies from 72 to 74 per cent. in the fresh sample and from 6 to 7 per cent. in the air-dried alfalfa. The amount of amino bodies varies considerably in the different cuttings, *i. e.*, from 5 to 20 per cent. of the total proteids, the time of the maximum amount being the period of half bloom, the bloom itself containing 20 per cent. of its nitrogen in the form of amino compounds. 18 analyses showed an entire absence of nitrates. The various parts of the plant have the following composition:

	H <sub>2</sub> O.	Ash.	Amino N of total N. Per cent.
Stems .....	60.	.....	low
Leaves.....	68.7	14.00	15.5
Flowers.....	72.7	like leaves	like leaves



Alfalfa yields 2.5 per cent. more hay and contains 7 per cent. more digestible food than clover. The bulletin also contains chapters on the manurial value of stubble, roots and their composition; the leaves and stem as a top dressing, the soil and its relation to alfalfa growing, ash analyses, and is illustrated with 18 plates.

J. A. LECLERC.

**Commercial Feeding Stuffs.** BY F. D. FULLER. *Penn. Dept. Agr. Bull.* 145.—339 samples, representing 248 brands of feeding stuffs were collected from 41 cities and towns of Pennsylvania and analyzed. Twenty-two guaranteed samples were deficient in protein and fat. Six samples were found adulterated, corn cob, rice hulls and oat hulls serving as adulterants. A copy of the Pennsylvania statutes, relative to the sale of feeding stuffs, a chapter on the composition of feeding stuffs with an explanation of the various chemical terms used, and a discussion of the analytical results, followed by a table giving the analyses of the feeds are included.

J. A. LECLERC.

**Feeding Stuffs.** *Maine Agr. Expt. Sta. Bull.* 129, *Vt. Agr. Expt. Sta. Bull.* 117.

J. A. LECLERC.

**Carbonated Milk.** BY L. L. VAN SLYKE AND A. W. BOSWORTH. *Science*, May 4, 1906, 712.—It was found that the simple impregnation of ordinary milk with carbon dioxide gas improved the keeping properties.

S. S. SADTLER.

**The Association Action of Bacteria in the Souring of Milk.** BY CHARLES E. MARSHALL. *Mich. Agr. Expt. Sta. Special Bull.* 33.—This bulletin is a continuation of a study of the influence of certain bacteria associated with lactic bacteria on the souring of milk. These microorganisms generally find their way into the milk through filth in some way or other, and associated with lactic bacteria produce various alterations in the milk.

J. A. LECLERC.

**Alfalfa.** BY WILLIAM P. HEADDEN. *Colo. Agr. Expt. Sta. Bull.* 110.—This bulletin presents many of the facts published in Bulletin 35 (see abstract of Bulletin 111 above) and other facts acquired since 1896. The Arabs introduced this plant into Spain, whence it was brought into California in the early fifties. The varieties used in the experiments were three French, a Turkestan, and the common home-grown. The composition of the French varieties differed but little, when grown in Colorado under the same conditions of soil and climate. About 20 to 24 inches of rain-fall are necessary for three cuttings of alfalfa. The average composition of the first cutting of alfalfa during three consecutive years follows: Water 6.86, ash 10.65, fat 1.54, protein 15.00, fibre 33.29, nitrogen-free extract 32.12. The leaves constitute 40 to

60 per cent. of the plant, and contain four-fifths of the total protein, over one-half of the nitrogen-free extract and fat, and only one-fourth of the fibre.

J. A. LeCLERC.

## PATENTS.

DECEMBER 26, 1905.

807,964. William P. Rice, Chicago, Ill. Assignor to the National Ozone Co., Chicago. **Apparatus for producing ozone.** Consists of a box, the opposing sides of which are thin and constitute the electrodes; they are joined at their margins by insulating strips in a manner to provide air-tight joints and to withstand internal pressure, the whole constituting a closed box and a dielectric between the electrodes, the outer sides of which are freely exposed to the atmosphere.

808,148. Charles A. Ernst, Lansdowne, Pa. Assignor to Silas W. Pettit, Philadelphia, Pa. **Filaments from viscose.** Viscose is made to pass through a perforated cap into and through a setting bath directly to the winding spool. Different lengths of the portion of the thread between the cap and the spool are subjected to different degrees of tension to apply a definite predetermined stretch to the filaments between the bath and the winding spool.

JANUARY 2, 1906.

808,618. Charles M. Allen, Lolo, Mont. Assignor to Ralph Baggaley, Pittsburg, Pa. Converting **matte.** Copper matte is bessemerized in a converting vessel having a non-silicious interior, until it reaches substantially the grade of white metal, then it is transferred to a smaller silica-lined converter, and the bessemerizing finished therein.

808,693. Louis Schutte, Philadelphia, Pa., and Ernst Korting, Pegli, Italy. **Calorimeter.** A calorimeter for measuring the heating value of gases, a heater having two sets of gas and water conduits, one set placed above the other, and the gas conduits in both sets connected in series, a water conduit leading to the bottom of the upper set, and from the top of the upper to the bottom of the lower set, and an outlet conduit leading from the top of the lower set, a gas burner below the lower set of conduits, means for feeding water to the heater and gas to the burners in automatically regulated proportionate volumes, and means connected with an inlet and outlet conduits of the heater for measuring the heat imparted to the water.

808,747. Fritz Hofmann, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y.  $\beta$ -Substituted **ester of diaminoglycerol.** A new benzoyl derivative of  $\beta$ -ethyltetramethyldiaminoglycerol, being an oil boiling at  $163^{\circ}$  under a pressure of 10 mm. and splitting on heating with hydro-

chloric acid into benzoic acid and  $\beta$ -ethyltetramethyldiaminoglycerol, and also being dibasic.

808,754. Wm. J. Jackson, San Francisco, Cal. Process of **heating ores**. Calcium oxide and water are added to powdered ores that are brought in contact with water, the reaction giving heat.

808,762. Max Kugel, Wiesdorf, near Cologne, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Yellow anthracene dye**. Derived from 1,3-dibromo-2-aminoanthraquinone, which is yellow and soluble in concentrated sulphuric acid yellow-orange, giving a blue vat with hydrosulphite and caustic soda, and dyeing unmordanted cotton blue shades turning brownish yellow on exposure to the air.

808,839. Justin H. Haynes and Wilbur D. Engle, Denver, Colo. Assignor to Dolores Refining Co., same place. Treating **ores**. Uranium and vanadium are separated from crushed ore by boiling with alkaline carbonate till the metal is dissolved, filtering and precipitating uranium with sodium hydroxide as sodium uranate, vanadium as calcium vanadate by slaked lime.

808,849. Walter E. Koch, Pittsburg, Pa. Treating **matte**. Iron and copper are separated by electrolyzing the molten matte flowing in a stream between electrodes, and simultaneously forcing gases into the matte.

808,919. John Hagenbach, Basle, Switzerland. Assignor to Anilin Color and Extract Works, same place. Red **azo dye**. The diazo derivatives of *o*-aminonaphtholsulphonic acids are combined with 1-phenyl-5-pyrazolone in position four, forming dark brown powders with slight metallic luster, soluble in water orange-yellow to red-brown, turning yellow to blue-red with acetic acid, giving on wool from acid bath yellow to blue-red shades, changing to crimson on chroming.

808,987. Paul Jeanmaire and Henry Schmid. Assignors to Arnold Print Works, North Adams, Mass. **Printing fabrics**. The process of making figures which consists in printing the dye and the mordant or other constituent separately, in overlapping, but different figures, so that in subsequent treatment the figures are formed where the different prints overlap, and all the rest is washed out.

809,053. Alexander Gordon, Weiser, Idaho. **Hardening sand lime bricks**. After molding in a moist state they are treated by dry heat and then by direct steam.

809,068. David Lichtenstein, Chicago, Ill. **Adhesive**. French glue, shellac and starch 8 each, alcohol 1, water 130 and coloring as desired.

809,068-7. Henry S. Blackmore, Mt. Vernon, N. Y. Extracting **sulphur**. Petroleum containing sulphur is cooled in



contact with zinc hydrogen carbide. The second patent uses for the same purpose nickel carbonyl.

809,088-9. To same for **caustic alkali**. A liquefied lead cathode is in contact with melted sodium chloride and a diaphragm of granulated magnetite, the weight of these substances depressing the level of the cathode by gravity, the salt being electrolyzed, and the electronegative products liberated by the diaphragm. The second is for passing mercury through an electrolytic cell containing a solution of alkali, decreasing the density and increasing the bulk of the cell contents till they overflow into an oxidizing cell through a non-conducting liquid (as  $\text{CS}_2$ ) adapted to break metallic contact, and separating the mercury from the alkali metal by gravity.

809,101. Karl Dietrich, Helfenburg, Germany. Stable **non-alcoholic iron compounds**. An unstable organic iron compound as iron albuminate is dissolved in distilled water with hydrochloric acid, the solution cooled to  $0^\circ$ , then saturating with  $\text{CO}_2$  under pressure and holding it two to three months.

809,121. Julius Lewy, Frankfort-on-Main, Germany. **Candle mixture**. Paraffin 85, stearin 5, and alcohol 10, an opaque mixture. Various proportions given.

809,138. Leopold Sarasin, Berlin, Germany. Assignor to C. F. Bohringer Sohne, Mannheim-Waldorf, Baden, Germany. **Milk preserve**. Milk containing lactic acid germs is evaporated *in vacuo* at below  $60^\circ$  to dryness, making a powder of agreeable acid taste.

809,218. Raoul P. Pictet, Berlin, Germany. **Separation of mixed gases**. A series of trays are provided with the heat exchanging pipes, provided with electrically operated valves whereby the gases are separated by means of their different boiling-points.

809,219. Raoul P. Pictet, Steglitz, Germany. **Dehydrating compressed gases**. The gases are passed through chambers containing liquids of progressively decreasing temperature, as glycerol cooled to  $-20^\circ$  to  $-40^\circ$ , etc.

809,225. Wilhelm Schmacher, Oberdollendorf, Germany. **Artificial paving bauxite** is sintered by heat, reduced to small pieces and mixed with a binding material as clay, asphalt or the like, moistened with water, molded and burned.

809,263. Wm. H. Hoyt and Wm. J. Gaven, Bridgeport, Conn. Assignors to the Burt Co., Hackensack, N. J. **Sound record**. Made of two layers of earthy matter and shellac, the record surface having less earthy matter than the lower surface. Terra-alba and baryta 10 each, flock 4, and shellac or Manila gum, is an example.

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809,278. Walther Bolsterli, Winterthur, Switzerland. Making

**solutions of silver salts.** In 30 liters of water 0.8 kg. of a silver salt is dissolved, then precipitated with 12 per cent. hydrochloric acid and the precipitate washed, then dissolved in 30 liters of water containing 3.3 kilos sodium hyposulphite with stirring and 1.8 kilos of 8 per cent. caustic ammonia and 8 kilos of finely triturated Spanish whiting added, whereby double salts are formed such as  $\text{Ag}_2\text{S}_2\text{O}_3$  and  $\text{Ag}_2\text{S}_2\text{O}_3\text{Na}_2\text{S}_2\text{O}_3\text{H}_2\text{O}$ .

809,279. Anton N. Brown, Arad, Austria-Hungary. **Stove polish.** Gum arabic 12, spirits turpentine 4, and water 74 parts, are boiled till the gum is dissolved; to 3 parts of this solution 1 part of an alloy of equal parts of aluminum and tin is added, well stirred and diluted till more is required.

809,347. Wolfgang Weichardt, Berlin, Germany. **Antitoxin for fatigue.** A pharmaceutical preparation containing an antitoxin against the poisons produced in man or animals by fatigue, which consists of the concentrated serum of animals treated with the toxins of fatigue, obtained from fatigued animals, and which has the property of neutralizing or destroying these toxins.

809,354. Eayre O. Bartlett and Wm. F. Gordon, Joplin, Mo. **Increasing the density of powders.** Air and gas are eliminated from pulverulent metallic salts and oxides by rotation in a tumbling barrel.

809,362. Max Englemann, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Dialkyl-barbituric acids.** Produced by heating 2-thio-4-imino-5-dialkyl-6-oxypyrimidine with acids.

809,381. Oscar J. Lanigan, Chicago, Ill. **Soldering flux.** Red oil 11, and resin 11 parts are mixed, melted and ammonia 5, water 100 added.

809,383. Leon P. Lowe, San Francisco, Cal. **Cleaning gases.** A volume of gas is forced through a tube in contact with a jet of steam, the whole impinging on a surface of water, with which the heavier impurities unite while the lighter gases escape and the steam is separated.

809,450. Rudolf Knietsch, Ludwigshafen-on-Rhine. Assignor to General Chemical Co., New York, N. Y. **Sulphuric anhydride.** Sulphur dioxide and oxygen are passed over platinum contact substance to partial conversion and this step is continuously repeated on the unconverted gases.

809,472. Benjamin C. Senton, Rutland, Vt. Assignor to Senton and Evans, New York, N. Y. **Solder.** Tin 12, zinc 2, aluminum and sodium chloride 1 part each.

809,492. Alexander Classen, Aachen, Germany. **Lustrous metallic coating** on metals. An electrolytic bath containing licorice, for example, zinc sulphate 20, sodium sulphate 4, zinc

chloride 1, and boric acid  $\frac{1}{2}$  part by weight, to 100 liters water and the extract of 5 kilos licorice root added.

809,550. Henry Blumenberg, Jr., Daggett, Cal. **Boric acid.** Sulphur dioxide is continuously produced and led into a mixture of sodium borate suspended in water, which is decomposed and the resulting boric acid evaporated.

809,583. Bruno R. Seifert, Radebeul, near Dresden, Germany. Assignor to Chemische Fabrik von Heyden. **Bismuth disalicylate.** A white powder containing one atom of bismuth and two molecules of salicylic acid, obtained by reacting with a normal bismuth salt on a salicylic acid whose base forms a soluble salt with the acid of the bismuth salt at a temperature below boiling, as sodium salicylate.

809,651. Solon Vathis, Paris, France. **Multicolored photographic proofs.** A sensitized surface is exposed and toned in a solution of hydrochloric acid and gold chloride, then fixed and heated where color is required to a minimum temperature of  $55^{\circ}$  and then washed with water.

809,731. Ottokar H. Nowak, Chicago, Ill. **Waterproof compound.** Dioxnaphthylmethane 5 per cent. dissolved in water and added to casein, and water or other adhesive.

809,739. Frederick H. Patch, Richmond, Va. **Adhesive.** Evaporated sulphide pulp liquor 4, oil and resin one each. For binding foundry cores.

809,770. Max Buttner, Wilmersdorf, Berlin, Germany. **Asymmetric cell.** A cathode of any metal or of carbon is combined with an aluminum anode and an electrolyte consisting of caustic ammonia and boric acid.

809,795. David Genese, Baltimore, Md. Assignor to Genese Cereal Manufacturing Co. Solidified **antiseptic compounds.** A mixture of glycerol 94 and sodium stearate 6 parts is heated to  $220^{\circ}\text{F}$ ., three to five hours, cooled to  $125^{\circ}\text{F}$ ., and volatile antiseptics, as menthol, thymol and eucalyptus in alcohol added.

809,842. Edgar F. Price, George E. Cox and James G. Marshall, Niagara Falls, N. Y. Assignors to Union Carbide Co. Electric furnace for **calcium carbide.** The electrodes of carbon are fixed in a sliding hood that enters the furnace and the end of the electrodes that pass through the wall of the hood are surrounded by a water jacket.

809,869. James Wakefield, Cockermouth, England. Bleaching **fibers.** Vegetable fibers are treated with a mixture of potassium permanganate and bleaching-powder, and then with an acidulated solution of bisulphite of sodium.

809,892-3-4. Oscar Bally and Max H. Isler, Mannheim, Germany. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. The first a **violet dye.** A  $\beta$ -amino-anthraquinone body is condensed with glycerol to form a benz-anthrone which is treated with caustic alkali to make a dye



soluble in concentrated sulphuric acid green and blue and yielding a blue vat with an alkaline hydrosulphite. The second is for an anthracene compound, a benzanthrone derived from  $\alpha$ -aminoanthraquinone in the presence of sulphuric acid. The third is also for an anthracene compound obtained from  $\alpha$ -aminoanthraquinone,  $\beta$ -chloranthraquinone and glycerol, which is a green powder soluble in concentrated sulphuric acid, red-brown with yellow-brown fluorescence, and on melting with caustic alkali gives a blue-violet dye from a hydrosulphite vat.

809,900. Henry S. Blackmore. Making **ketones**. A carbon acid and a hydrocarbon are mixed and heated by passing through a gauze diaphragm heated by electricity to make acetone.

809,909. Peter C. D. Castle, Bebington, England. Artificial **mother of pearl**. The pearly matter of shells is finely pulverized and mixed and pressed hot with gum sandarac, ground mica and talc.

JANUARY 16, 1906.

809,935. Arthur Eichengrün and Theodor Becker, Elberfeld, Germany. Assignors to Farbenfabriken of Elberfeld Co., New York, N. Y. **Cellulose acetate**. Obtained by treating cellulose with acetic anhydride and sulphuric acid, that wet is a whitish voluminous mass and dries in hard yellowish lumps, soluble in 70 per cent. hot alcohol, the solution solidifying in the cold to a gelatinous mass, and forming transparent flexible sheets and films on evaporation of its solutions.

809,955. John W. Ippers, New York, N. Y. Assignor to Albert Henry Walker, same place. **Photomechanical printing**. The original is photographed through a half-tone screen, copied on a sensitive gelatine plate on an elastic base, the gelatin plate developed and soaked in water to swell the dark areas, drying, coating the relief with glycerol, the depressed areas are inked and transferred to a metal roller, and the roller is etched on the uninked areas.

809,959. Edmund B. Kirby, Rossland, Canada. Separating **minerals**. The powdered ore is mixed with a large quantity of water and a solution of bitumen in a light hydrocarbon, by which the mineral particles are coated and ultimately float on being blown up by a gas; they are removed and the hydrocarbons adhering are distilled off.

809,998. August Stillesen, New York, N. Y. Artificial **fuel**. Petroleum 75, turpentine 16, sodium palmitate and water 2 parts each and caustic soda 5 parts, the whole well incorporated.

810,022. Ralph Baggaley, Pittsburg, Pa. **Vitrified brick**. The silicate of iron slag from copper smelters is molded, cooled, compressed and annealed in a bed of dry sand.

810,044. Byron E. Eldred, Bronxville, New York, N. Y. Assignor to Combustion Utilities Co., same place. **Burning ceramics.** A voluminous slow-burning flame is produced with a dilute air-draft containing free oxygen, and the volume of flame increased as the burning proceeds.

810,059. Tom C. King, New York, N. Y. Assignor to National Metallurgic Co., Jersey City, N. J. Preventing **scaffolds in kilns.** Calcium fluoride is volatilized and forced against the walls of the kiln where masses of clinker adhere. They are thereby melted down.

810,086. Wm. F. Rudel, Aurora, Ind. Assignor to Albert T. Gridley, same place. Making **starch.** Corn is steeped in hot water at 150 to 160°F., ground and the hulls separated, then caustic soda added to 12/10000, the whole run, and the starch settled, and washed, caustic soda added to 30/10000, and the starch settled in boxes till it is ready for the crusting room.

810,105. John Callahan, Seattle, Washington. **Cleaning compound.** Alkali 79, cutch and glucose 10 each, and 1 part of carmine.

810,249. Ralph Baggaley, Pittsburg, Pa., Charles M. Allen, Lolo, Mont., and Edward W. Lindquist, Chicago, Ill. Allen and Lindquist, assignors to Baggaley. **Refining copper.** Sawdust is injected by air pressure into a Bessemer converter before the oxidation is completed.

810,312. Paul F. Vogel, St. Louis, Mo. Assignor to Walter W. Calmore, Philadelphia, Pa. **Ageing dyed fabrics.** The fabrics are saturated with an oxidizable dye, then aired in a rotating drum, the temperature being first raised and then lowered and the ageing completed at normal temperature.

JANUARY 23, 1906.

810,394. Bernhard Cleff, Raumenthal, Germany. Assignor to Susquehanna Silk Mills, New York, N. Y. **Oxidizing fabrics.** The fabric is first saturated in a suitable apparatus with chemicals giving an oxidizing reaction when heated. It is then carried in mass to another chamber which is closed, having a high temperature and a moist atmosphere; it is left in this chamber a relatively short time, maintaining throughout the same temperature and the same degree of moisture, after which it is removed.

810,442. Charles Sudre, Paris, France. **Treatment of vinasses.** The vinasse is rendered acid and is then caused to flow in a vacuum along a surface heated to a maximum temperature of 300°, the steam generated is given a gyratory movement whereby it is freed from particles carried with it. By this treatment the contained glycerol is obtained in the form of a mixture with water and a residue is also obtained containing all the ammonia.

810,454. Charles E. Acker, Niagara Falls, N. Y. Assignor to Acker Process Co. **Making stannic chloride.** Metallic tin is brought into contact with a solvent containing chlorine whereby a solution of stannous chloride is formed which is then subjected to the action of a gaseous mixture containing chlorine, hydrochloric acid and oxygen to produce stannic chloride. This is then further treated with metallic tin and again converted into stannous chloride, the operation being repeated until the desired concentration has been reached.

810,455. Same. **Making stannous chloride.** Substantially the same as for stannic chloride, the process being stopped when the stannic chloride formed has been treated with the gaseous mixture of chlorine, hydrochloric acid and oxygen.

810,456. Same. **Making chlorine compounds of tin.** A solvent for tin is subjected to the alternate action of metallic tin and chlorine or a gaseous mixture containing chlorine, the mixture being cooled to avoid the tendency to produce metastannic compounds.

810,531. Robert A. Hadfield, Sheffield, England. **Hardening steel.** Steel is raised to a temperature not less than  $850^{\circ}$  and not more than  $1150^{\circ}$ , then permitted to cool, and again heated to a temperature not higher than  $720^{\circ}$  and then permitted to cool slowly.

810,572. Joseph Savelsberg, Papenburg, Germany. **Treating ores.** The ore is mixed with sulphur-containing substances, pulverized carbon and a flux, and is charged into a suitable furnace over a bed of glowing carbon and ore; the charge is then blown to cause the sulphur to combine with the metal of the ore and sinter the mass.

810,740. Martin E. Fisher, Mineral City, Ohio. **Making hard-rubber balls.** India rubber 2, coal flour 2, sulphur flour 1, and talc powder 3 parts are mixed, molded and vulcanized under high pressure to produce a hard-rubber core-ball, upon which as a center is molded a larger ball of the same composition less the talc, and vulcanized under low pressure.

810,745. Hugo Gronwald, Berlin, Germany. **Pasteurizing beer.** The quantity of beer required to fill the barrel in which it is to be transported is divided between such barrel and a receiver below it and between which there is a pipe connection; the two vessels are freed from air by means of carbon dioxide, so that the receiver is filled completely and an empty space equal to its contents is left in the barrel in order that the carbon dioxide disengaged from the beer in the barrel and received during the pasteurizing may collect in the barrel and after cooling be returned to the beer without loss by shaking or other known means, whereupon the pasteurizing apparatus is placed upon the floor with the



barrel at the bottom so that the receiver can empty itself into the barrel and the excess of carbon dioxide mount up into the receiver.

810,838. Peter B. Bird, New York, N. Y. **Boiler compound.** Proportions of vegetable astringent and alkali are boiled together, and a carbohydrate is dissolved therein by boiling, and when at a suitable temperature a solution of mercury in an animal oil is added to form a paste of permanent character.

810,889. Otto C. Strecker, Darmstadt, Germany. **Electrically preparing metals or alloys for lithographic purposes.** A water-retaining layer is produced upon metal plates by submitting them, after they have been suitably prepared and provided with lithographic designs, to the action of a continuous current which passes from a suitable cathode to the plate to be treated and causes the ions of the substances employed in the electrolytes to form a layer which consists of oxides or hydroxides of the metals applied; the plate is subsequently submitted to the action of suitable acids or chemicals by which the layer will be transformed into insoluble salts of the metal or plates applied which will retain water and repulse lithographic oil or grease.

JANUARY 30, 1906.

810,930. William Fennell and William P. Perry, Leytonstone, England. **Storage battery.** There is an electrode made of a non-conducting material insoluble in the electrolyte as burnt clay, and pierced in several directions with intercommunicating passages, the walls of which are lined with an active material.

811,017. Oscar Wiederhold, Jersey City, N. J. **Making mantles.** Fabric for incandescent mantles is made from threads of raw cotton which contain impurities detrimental to the production of perfect impregnation, but beneficial to the production of the fabric; the fabric is then subjected to the action of a bleaching reagent which is afterward removed with the impurities, and the fabric is then impregnated with the incandescing material.

811,040. George L. Davidson, Chicago, Ill. Assignor to the American Sintering Co., Chicago, Ill. **Sintered comminuted ore or flue dust.** The ore or flue dust is mixed with a small percentage of comminuted fluorspar and the mixture gradually passed through a furnace and heated until it fuses sufficiently to cohere, and it is then agglomerated into lumps by agitation while it is in a partly fused condition.

811,044. Carleton Ellis, Roslindale, Mass. Assignor to Chadeloid Co., New York, N. Y. **Paint and varnish remover.** Consists of methylacetone 95, benzene 100, other paint and varnish solvents, a wax, 20, and a wax solvent.

811,074. Martin J. Manix, Kansas City, Mo. **Disinfecting compound.** Potassium chlorate 2 parts, sulphur 2 parts, strontium nitrate 6 parts, shellac 1 part, potassium nitrate

1 part, and sawdust 15 parts are kneaded into a paste and permitted to dry in paste-board tubes.

811,095. Edwin C. Pohle, Reno, Nevada. **Recovering values from sulphide ores.** Ores containing gold, silver and other metals are mixed with a chloride and subjected to a combustion flame with an excess of air; the gaseous products are led off and the metallic vapors are condensed and collected; the solid products are cooled and the mass leached with water to remove the bodies soluble in it; the residue is leached with a cyanide of an alkali metal and the gold and silver precipitated from the solution.

811,193. Emil Worner, Berlin, Germany. Assignor to the firm of J. D. Riedel, Aktiengesellschaft, Berlin. **Mercury salts of cholic acid.** A suitably dilute salt of cholic acid is treated with a mercury salt of an organic acid, as acetic acid, to form a precipitate which is then mechanically separated.

811,227. George Kelly, Hinsdale, Ill. **Composite insulating material.** A wet body of flax fiber and mineral wool is stirred until they are thoroughly commingled, the stirring being stopped before pulping takes place, and the mixture is formed into a tile, board or slab or other form.

811,239. Ambrose Monell, New York, N. Y. **Nickel-copper alloys.** Ores containing the sulphides of copper and nickel are smelted and the resulting matte is then bessemerized; the bessemerized product is then calcined to bring the metals into the form of oxides which are then reduced, by which a malleable copper-nickel alloy is made directly without separating the metals from each other.

811,433. Alfred R. Pechiney, Salindres, France. Assignor to Compagnie des Produits Chimiques d'Alais et de la Carmague, Lyon, France. **Calcination of hydrated alumina.** Hydrated alumina is mixed with a solution of a fluoride, as aluminum fluoride, there being about one part of fluoride to about 100 parts of anhydrous alumina, and calcined at about 1200°.

811,466. Edward T. Williams, Boston, Mass. **Food compound.** The product consists of comminuted lean animal tissue, stearin and tallow, thoroughly mixed. The animal tissue is first subjected to a temperature of 212° to destroy the germs of putrefaction and is then mixed with a sterilized compound of stearin and a fat of lower melting-point than the stearin.

811,471. Oscar Bally, Mannheim, and Hugo Wolff, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Anthracene dye.** From  $\alpha$ -aminoanthraquinone is obtained a benzanthrone which upon treatment with a caustic alkali forms coloring-matters which dissolve in concentrated sulphuric acid,

yielding olive-green solutions, and which dissolve in alkaline hydrosulphite, yielding blue to violet vats which dye vegetable fibers substantively giving bluish shades.

811,477. Ernest Brühl, Berlin, Germany. **Foundry dusting powder.** Consists of a resinous substance as shellac incorporated with silicious marl.

811,523. Francis L. Stewart, Murraysville, Pa. Assignor one-half to Samuel E. Gill, Pittsburg, Pa. **Making maize sugar.** While still in the milk and before they reach maturity the ears are separated from the growing field maize to sterilize it; the growth of the stalk is allowed to continue for more than two weeks until an increase of the sugar content in it takes place. The juice is then extracted, clarified and reduced to sugar or syrup.

FEBRUARY 6, 1906.

811,552. James H. Bridge, New York, N. Y., and Carleton Ellis, Boston, Mass. **Hydrated lead oxide.** Assigned one-third to Sawyer, Foster and Hardy, Boston, Mass. A hot aqueous solution of sodium chloride is electrolyzed with lead anodes, the anolyte and catholyte are mixed and the hydrated lead oxide is removed and the original electrolyte regenerated.

811,563. John P. Ihart, New York, N. Y. **Varnish.** Consists of that fraction of oil-gas tar which passes over below 200° mixed with aluminum chloride.

811,718. Frank E. Hatch, Winnipeg, Canada. **Hoof mixture.** Ammonia and copper sulphate 1 each, saltpeter and sal ammoniac 16 each, and water 500 parts.

811,725. Arthur W. King, London, England. Assignor to Charles Rogers, same place. **Aluminum solder.** Soft solder 10, pure zinc and aluminum 5 parts each. Mixed at a low red heat. Used partly as a flux for common solder.

811,750. Frederic O. Spieske, Brooklyn, N. Y. **Heat-storing compound.** Sodium acetate, sodium hyposulphite, and calcium chloride are mixed as required to make the desired temperature and avoid hard sharp crystals that injure the rubber bag.

811,759. Wm. C. Arsem, Schenectady, N. Y. Assignor to General Electric Co. **Electrodeposition.** The alternating current is passed between electrodes immersed in a solution of a platinum salt as ammonium chlorplatinat in sodium citrate, the reverse current not corroding the deposited metal.

811,778. Charles C. Hall, Alexandria, Ind. **Insulating material.** Asbestos 92 and wood pulp 8 per cent., the mixture saturated with paraffin or tallow, etc.

811,826. Max Conrad, Aschaffenburg, and Walter Becke, Darmstadt, Germany. **4-Imino-2-6-dioxypyrimidine.** Urea and a cyanacetic ester as methyl ester are condensed in the presence of alkali.

WM. H. SEAMAN.



# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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## GENERAL AND PHYSICAL CHEMISTRY.

**Some Properties of the  $\alpha$ -Rays from Radium.** BY E. RUTHERFORD. *Trans. Roy. Soc. Canada*, **11**, Sec. 3, 3 (1905); *Phil. Mag.* [6], **10**, 163-176 (1905).—From measurements of the deviation of the  $\alpha$ -rays of radium C,  $\frac{mV}{e} = 398,000$ .  $V$ , the velocity of the rays, was calculated from the heating effect of radium C to be  $2.6 \times 10^9$  cm. per sec. Therefore,  $\frac{e}{m}$ , the ratio of charge to mass,  $= 6.5 \times 10^3$ . The velocity of the  $\alpha$ -particles is diminished 36 per cent. in passing through 12 layers of aluminium foil, each 0.00031 cm. thick; the photographic effect and also the phosphorescent action on zinc sulphide, etc., then cease suddenly. No effect could be observed through 13 layers. Each layer of the foil absorbs 4.9 per cent. of the maximum energy of the rays. From the fact that the ranges for electric, photographic and phosphorescent activity are all practically the same, the author concludes that the last two, like the first, are due to ionization. In the so-called rayless changes, rays may be produced, but at a velocity too small to produce ionization. H. N. McCoy.

**On the Ultimate Disintegration Products of the Radioactive Elements.** BY B. B. BOLTWOOD. *Am. J. Sci.* [4] **20**, 253-267 (1905). The final inactive products of radioactive elements may be common elements. The author has studied the composition of radioactive minerals with the object in view of finding what elements most frequently accompany uranium and thorium. Lead invariably accompanies uranium in a primary mineral. It is well known that radium always accompanies uranium. It is now thought that lead may be the final product from radium, the latter being a product of uranium. Bismuth, barium, the

rare earths, hydrogen and argon also very frequently accompany the active elements and may be among the final inactive products.

H. N. McCoy.

**Scintillations Produced by Radium.** BY R. W. WOOD. *Phil. Mag.* [6] 10, 427-430 (1905).—The author compared the duration of the flashes produced on a zinc sulphide screen by radium rays with those produced mechanically on the rapidly rotated screen by contact with a very light glass rod. At a high speed of rotation the radium flashes were but slightly elongated, while the others were drawn out into long arcs. The  $\alpha$ -ray flashes last  $\frac{1}{15000}$  to

$\frac{1}{20000}$  sec.; those produced by mechanical cleavage persist much

longer. The two phenomena are not exactly alike; the real nature of the former is not clear.

H. N. McCoy.

**The Absorption of the  $\alpha$ -Rays.** BY R. K. McCLUNG. *Phil. Mag.* [6] 11, 131 (1906).—The author measured the activity of the  $\alpha$ -rays of radium C according to the method of Bragg and Kleeman (*Phil. Mag.* 10, 318) and obtained practically identical results. The maximum range, or distance at which ionization ceases in air, is 6.8 cm. The range is diminished 0.53 cm. by each successive layer of aluminium foil, 0.00031 cm. thick, placed over the active substance.

H. N. McCoy.

**The Effect of High Temperature on the Rate of Decay of the Active Deposit from Radium.** BY HOWARD L. BRONSON. *Phil. Mag.* [6] 11, 143-153 (1906).—The results of the preliminary report (*this Rev.* 11, 598) are confirmed by further investigations. A "constant deflection" method for the measurement of rapidly charging ionization currents, is described. The quadrant of the electrometer to which the testing vessel is connected is also connected with an electrode beneath which is a highly radioactive body kept at a constant potential below that of the earth. For details of the method, which yields very good results, see the original paper.

H. N. McCoy.

**The Absorption of the  $\gamma$ -Rays of Radioactive Substances.** BY A. S. EVE. *Phil. Mag.* [6] 11, 586-595 (1906).—The  $\gamma$ -rays of radium, uraninite, thorium and radiothorium are equally absorbed by lead. The absorption coefficient,  $\lambda$ , (based on unit thickness) varies from 0.57 to 0.46. The  $\gamma$ -rays of pure uranium compounds are more readily absorbed,  $\lambda=1.4$ . The  $\gamma$ -rays of actinium are not homogeneous; there is no constant absorption coefficient. The author proposes the use of 1 kilo of thorium nitrate, contained in a vessel 16 cm. in diameter, and covered with 1 cm. of lead, as a standard of activity. About 18 per cent.

of the  $\gamma$ -ray activity of such a standard is absorbed in the thorium compound itself. H. N. McCoy.

**The Radioactivity of Thorium Minerals and Salts.** BY B. B. BOLTWOOD. *Am. J. Sci.* [4] 21, 415-426 (1906).

**The Relation between the Radioactivity and the Composition of Thorium Compounds.** BY H. N. MCCOY AND W. H. ROSS. *Am. J. Sci.* [4] 21, 433-443 (1906).—These two papers represent entirely independent investigations on the same subject, published simultaneously in the same journal. The methods and results are so similar that the papers may best be reviewed together. In both cases the activity per gram was determined by the use of very thin films of the active substance (McCoy, this Journal, 27, 391 (1905)). It was found that all thorium minerals contain uranium. When the activity due to uranium and its products is deducted the remaining activity, due to thorium and its products, is proportional to the thorium content of the mineral. Boltwood found that the thorium activity, per gram of that element, was constant when measured by either of two electrosopes of different size, but was smaller for the one with smaller ionization chamber. Boltwood's results are expressed in arbitrary units. McCoy and Ross express the activity in terms of that of 1 sq. cm. of a thick film of  $U_3O_8$  as unity. The total activity of 1 gram of thorium in a mineral was found to be 950, while that of 1 gram of uranium is 3280 in a mineral and 790 in a pure compound. Both researches showed that the activity of thorium in the pure  $ThO_2$ , obtained in the course of analysis as well as in some other ways, was the same as that of thorium in a mineral. But it was also found in both cases that thorium of about half this activity could be prepared by various processes. The reduction of the activity of such samples was ascribed to the partial removal of radio-thorium. The results, in both cases, are interpreted as showing that thorium produces the radioactive bodies, radio-thorium,  $ThX$ , etc., which are associated with it. The change of thorium into radio thorium may be rayless. H. N. McCoy.

**The Radioactivity of Thorium.** BY H. M. DADOURIAN. *Am. J. Sci.* [4] 21, 427-432 (1906).—The problem discussed in the two preceding papers was studied, independently, by the author, by a different method. A negatively charged copper plate was exposed to the emanation from a fixed volume of a solution of the thorium mineral or pure compound. After nineteen hours the activity of the plate, due to Thorium B, was determined. For a mineral, the activity was proportional to the amount of thorium in the solution. For some pure thorium preparations the same activity per gram of thorium was found as for minerals; in other preparations only about half this activity was observed. The



results are in harmony with those of the two preceding papers, and similar conclusions are expressed. H. N. McCoy.

**The Radioactivity of the Salts of Radium.** BY B. B. BOLTWOOD. *Am. J. Sci.* [4] **21**, 409-414 (1906).—After taking into consideration the deficiency in activity due to the spontaneous loss of emanation from a thin film of radium bromide, it is found that the total activity of radium plus the equilibrium amounts of its products, Em, A and C, but not E and F, is 5.64 times as great as that of radium alone. From the fact that the sum of the ranges of radium and the same products is 5.60 times that of radium alone, the author concludes that the activity of radium or any product is proportional to its range. H. N. McCoy.

**The Relative Proportion of Radium and Uranium in Radioactive Minerals.** BY E. RUTHERFORD AND B. B. BOLTWOOD. *Am. J. Sci.* [4] **22**, 1-3 (1906).—It was discovered that the earlier results, on the same subject (*this Rev.* **11**, 595), were erroneous because the assumed concentration of the standard radium solution was incorrect. A repetition of the experiments with a new radium solution showed that 1 gram of uranium is associated, in a mineral, with  $3.8 \times 10^{-7}$  grams of radium. One ton of 60 per cent. uranium ore contains 0.20 gram of radium.

H. N. McCoy.

**On the Absorption of the  $\alpha$ -Rays from Polonium.** BY M. LEVIN. *Am. J. Sci.* [4] **22**, 8-12 (1906).—The range of the  $\alpha$ -rays from polonium was found, by the scintillation and the electrical methods, to be 3.86 cm. in air. When the polonium is covered by from 1 to 7 layers of thin aluminium foil, each layer cuts down the range 0.50 cm.

H. N. McCoy.

**A Symposium on Chemistry Requirements.** BY J. F. SELLERS. *Science*, **23**, 730-736.—This paper, read at the New Orleans meeting of the American Chemical Society, December 30, 1905, embodies the results of the author's inquiries addressed to a large number of the more important colleges of our southern states, with the object of ascertaining the present scope and trend of chemical work in the South. W. F. HILLEBRAND.

**On the Adsorption of Water Vapor and of Certain Salts in Aqueous Solution by Quartz.** BY LYMAN J. BRIGGS. *J. Physic. Chem.* **9**, 615-640.—This investigation on adsorption was carried out with a view to its significance in soil chemistry. In working with salts the solutions, together with powdered quartz, were placed in prepared glass bottles and shaken for thirty hours, titrations being made before and after shaking. The hydroxides and carbonates of sodium, potassium and ammonium were investigated in this manner as were also sodium, ammonium and

magnesium chloride, sodium nitrate and sodium sulphate. Both the hydroxides and the carbonates were found to be adsorbed in measurable amounts, the former in somewhat larger amount than the latter. The amount of adsorption is not directly proportional to the concentration, a relatively greater amount being adsorbed in the more dilute solutions. Experiments were likewise carried out on the absorption of potassium hydroxide by quartz sand, a platinum bottle being employed as container. The solutions were 0.1 normal and a sufficient quantity was used to just fill the space between the grains of sand. The amount adsorbed was about 1 per cent. of the total base present and it was calculated that this corresponds approximately to an adsorption of  $1.66 \times 10^{-5}$  grams molecules per square meter. A measurable adsorption was not found with any of the neutral salts. The author concludes that the marked retention of salts observed in connection with soils is due to other causes than adsorption on the surface of quartz particles. Measurements were further carried out on the adsorption of water vapor by quartz. Powdered quartz was subjected to the action of water vapor at different pressures, the containing apparatus being rotated in a thermostat at  $30^{\circ}$  in order to avoid possible condensation, due to capillary action. The amount of adsorption was determined by weighing the water vapor after adsorption in phosphorus pentoxide. Two methods of drying were employed. In one case the quartz was exposed to phosphorus pentoxide at ordinary temperatures, in the other the quartz was dried at  $110^{\circ}$ . The amount of water vapor adsorbed with 1 per cent. of saturation was found to be 26.6 mg. per square meter, the drying being carried out at  $110^{\circ}$ . With increasing density of water vapor adsorption increases. A part only, of the condensed film, is given off at  $30^{\circ}$ . From experiments with washed quartz the conclusion is drawn that the adsorption can not be accounted for by ascribing it to the action of soluble substances on the surface film.

C. A. KRAUS.

**Adsorption of Dissolved Substances.** BY PERCY N. EVANS. *J. Physic. Chem.* **10**, 290-298.—These experiments were carried out chiefly with filter-paper, although silica, prepared from sodium silicate, was employed in one instance. In most cases, though not in all, adsorption was found to take place. In general the adsorption was not measurable in concentrated solutions, increasing, however, with increasing dilution and passing through a maximum. The author states that "no cases were found of negative adsorption."

C. A. KRAUS.

**The Solubility of Gypsum in Magnesium Sulphate Solutions.** BY F. K. CAMERON AND J. M. BELL. *J. Physic. Chem.* **10**, 210-215.—Since analytical methods for calcium fail in the presence of large quantities of magnesium, an indirect method was resorted

to for determining the amount of calcium. The method consists essentially in placing a weighed crystal of selenite ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) in a solution of magnesium sulphate of known strength. When equilibrium has been reached, the crystal is weighed and the density of the solution determined. The necessary data are thus obtained for determining the solubility of calcium sulphate in solutions containing varying amounts of magnesium sulphate. The solubility curve exhibits a minimum at 13 grams  $\text{MgSO}_4$  and 1.46 grams  $\text{CaSO}_4$  per liter, and then a maximum at 105 grams  $\text{MgSO}_4$  and 1.64 grams  $\text{CaSO}_4$  per liter. For a saturated solution of  $\text{MgSO}_4$ , containing 355 grams per liter, 0.50 gram of  $\text{CaSO}_4$  per liter were found. The authors suggest the use of the solubility curve in analytical determinations of calcium in the presence of large quantities of magnesium. Several explanations are offered for the peculiar form of the solubility curve. C. A. KRAUS.

**On the Relation between Electrolytic Conduction, Specific Inductive Capacity and Chemical Activity of Certain Liquids (with Bibliography of Dielectric Constants).** By JOSEPH HOWARD MATHEWS. *J. Physic. Chem.* **9**, 641-681.—The dielectric constants of a number of solvents are determined while a number of others are redetermined. Measurements were likewise made on a number of mixtures from which it follows that in some cases the dielectric constant of the mixture may be greater than that of either of its constituents. Conductivity measurements of a qualitative nature were carried out on a considerable number of solutions in the mustard oils and the sulphocyanates, as well as in methyl and ethyl silicates. Iodine dissolved in the mustard oils, was found to be a conductor, but reaction sets in on standing. The action of acids, dissolved in nitrobenzene and some other solvents, was studied and in the case of a considerable number of metals action occurred, although the solutions were comparatively poor conductors. A bibliography of the literature dealing with dielectric constants is appended.

C. A. KRAUS.

**A Correction.** By JOSEPH HOWARD MATHEWS. *J. Physic. Chem.* **10**, 216.—A number of corrections to the preceding paper are here given.

C. A. KRAUS.

**A Correction.** By H. C. JONES. *Phil. Mag.* **10**, 157-159.—The author's work has recently been cited by Kahlenberg (*this Rev.* **11**, 382) in support of his (Kahlenberg's) views on the process of electrolytic conduction. It is pointed out, that to be of value in interpreting the results of conductivity measurements, molecular weight determinations should extend over a considerable range of dilution. If the molecular weight of a substance should be found normal over a considerable range of dilution while its solutions at the same time are good conductors, great importance



would be attached to the results. Attention is called to the results of conductivity and molecular weight determinations on cadmium iodide, ammonium sulphocyanate, sodium iodide and mercuric chloride dissolved in acetone. While mercuric chloride has a normal molecular weight practically independent of dilution, its solutions are very poor conductors. The other salts, on the other hand, are good conductors but their molecular weights are not normal and decrease with increasing dilution.

C. A. KRAUS.

**The Theory of Electrolytic Dissociation.** (A rectification of the "correction" by Professor Harry C. Jones.) By LOUIS KAHLENBERG. *Phil. Mag.* **10**, 662-664.—Replying to the criticism of his paper by Jones (preceding review), the author states that the reference to the work of Jones and his students relates only to aqueous solutions, namely, the freezing-point determinations, and not to solutions in acetone as Jones supposes.

C. A. KRAUS.

**On the Nature of the Process of Osmosis and Osmotic Pressure with Observations Concerning Dialysis.** By LOUIS KAHLENBERG. *J. Physic. Chem.* **10**, 141-209.—A study is made of the relations between membrane, solvent, and solute and the process which goes on when the three are brought together in an osmotic cell. To illustrate the action of the membrane in an osmotic cell, the author considers the system consisting of three layers, chloroform *A*, water *B*, and ether *C*. In this system *C* passes through *B* into *A* and *A* passes through *B* into *C*, the passage of *C* into *A* being the more pronounced. The process here depends not alone on the properties of *A* and *C* but also on the relation of both these to the intervening layer *B*. Similarly in the case of osmotic cells, the relation of the two liquids to the membrane must be considered. Substances similar in nature to the membrane should in general pass through it, while substances of dissimilar nature should not pass through. Using this principle as a guide, the author was able to predict the behavior of a given membrane in the presence of given substances. A large number of qualitative observations are recorded, showing the direction of the osmotic current in different cases. Organic substances as a rule pass readily through rubber and other organic membranes, while salts do not pass through, or only in small quantities. Organic solids such as camphor, when placed in contact with pyridine, with a rubber membrane between, readily pass through the membrane. Among the numerous experiments recorded, the following are some of the more striking. A solution of 0.05 normal silver nitrate in pyridine gives practically zero pressure (0.5 cm. of pyridine) when a rubber membrane is employed. This membrane does not allow silver nitrate to pass

through in appreciable quantity. A normal solution of silver nitrate gives only 15.6 cm. (of pyridine) pressure at  $-15^{\circ}$  while at  $20^{\circ}$ , with a specially constructed cell, the same solution gives an osmotic pressure as high as 15 atmospheres, although it is not claimed that equilibrium was reached here. Quantitative measurements were carried out with cells in which rubber was employed as membrane and the solutions consisted of sugar and lithium chloride dissolved in pyridine (0.125 normal). In order to reach equilibrium it was found necessary to stir the solution within as well as the solvent without the cell. Two cells were run in duplicate and it was shown after each experiment that no solute had passed through the membrane in appreciable amount. With lithium chloride the maximum pressure observed was 54.7 cm. at  $19.6^{\circ}$ , although there was considerable variation from this value. On the other hand, near  $0^{\circ}$  with the same cell a pressure of 9.0 cm. was recorded in one case and 2.9 cm. in another. At  $58.7^{\circ}$  the pressure reached 128.3 cm. With sugar a maximum pressure of 98.3 cm. was obtained at  $20^{\circ}$  with a variation of 10 per cent. At  $0^{\circ}$  the pressure observed was only a few millimeters and at  $46^{\circ}$  it was 114.2 cm. The author shows further that a non-crystalline body, copper oleate, may be separated from a crystalline body, sugar by dialysis, the non-crystalline body passing through the membrane. The general conclusion is drawn that the gas laws do not hold for solutions. It seems to the reviewer that a critical analysis of what is understood by the term "semipermeable membrane" would be helpful in connection with this paper.

C. A. KRAUS.

**Concentration Cells in Liquid Ammonia.** BY HAMILTON PERKINS CADY. *J. Physic. Chem.* **9**, 477-503.—A study is made of concentration cells in liquid ammonia with a view to comparing the experimental values with those calculated theoretically. On account of experimental difficulties, no attempt is made to apply the Helmholtz formula, approximate formulas being used in determining the calculated values. In principle, the method of making the measurements resemble those employed in the case of ordinary solvents. The experimental difficulties are, however, much greater, for which reason a somewhat complicated apparatus had to be used, for a description of which the reader must be referred to the original. Measurements were carried out on the following combination: amalgam, solution of salt (concentration  $C_1$ ), solution of salt (concentration  $C_2$ ), amalgam. The salts employed were, sodium chloride, sodium nitrate, silver nitrate, and lead nitrate. The concentrations were varied between about 0.05 and 0.002, and 0.007 and 0.00008 gram-molecules per liter for the two solutions respectively. The measured electromotive force lay between about 0.023 and 0.115 volt. Calculating the electromotive forces from the formula

$$E = 0.000198 T \log \frac{c_1}{c_2},$$

when the symbols have their customary significance, it was found that the observed electromotive forces are lower than those calculated by as much as 10 to 20 per cent. Since, in deriving the formula, it was assumed that the salt is completely dissociated in solution, a close agreement was not to be expected, particularly after taking into account the small dissociating power of ammonia. Assuming the concentration of the ions to be proportional to the conductivity of the electrolyte, *i. e.*, inversely proportional to its resistance, the following formula is applied in calculating the electromotive forces

$$E = 0.000198 T \log \frac{R_2}{R_1},$$

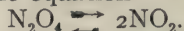
when  $R_1$  and  $R_2$  are the respective resistance of the two solutions. The agreement with observed values is somewhat better when this formula is applied. When corrections are applied for the potential difference between the two electrolytes, the agreement is not so good. Measurements were also carried out with a cell in which the liquid contact was avoided, the arrangement being as follows: Sodium amalgam, sodium chloride solution (concentration  $C_1$ ), cadmium chloride, cadmium amalgam; cadmium amalgam, cadmium chloride, sodium chloride solution (concentration  $C_2$ ), sodium amalgam. The formula to be applied here, differs from the preceding one in that the factor 2 must be introduced. The agreement was in this case within about 8 per cent. By combining the expressions for the electromotive forces with and without liquid contact, the transference number of the anion may be calculated. The electromotive forces obtained with the cell without liquid contact, were not sufficiently constant to be used in this connection. Cells, in which the electromotive forces were due to concentration difference in two sodium amalgams, were likewise investigated. The ratio of the observed to the calculated electromotive force was found to agree with that found earlier with pyridine as solvent. Further, the electromotive force was found to be a function of the absolute concentrations as well as of the ratio of the concentrations of the amalgams. The differences between observed and calculated electromotive forces were found to decrease with increasing temperature, indicating a change in the heat of dilution of the amalgam. Measurements were also carried out on oxidation and reduction cells, potassium permanganate serving as oxidizing agent and ammonium acetate, potassium iodide, and sodium sulphite as reducing agents.

C. A. KRAUS.

**The Fundamental Functions of One-Component Ideal Constituent Gases.** BY J. M. BELL AND J. E. TREVOR. *J. Physic.*



*Chem.* **9**, 178-209.—The authors develop the thermodynamics of an ideal gas which dissociates, as does, for example, nitrogen peroxide according to the equation



Comparison is made with experimental results in the heat developed on cooling nitrogen peroxide at constant pressure. A good agreement was found. C. A. KRAUS.

**On Air Liquefiers.** BY F. G. COTTRELL. *J. Physic. Chem.* **10**, 264-274.—The author compares the efficiency of a Hampson liquefier, run in the usual way, with a modified liquefier in which the air, just before reaching the expansion valve, passes through a copper coil immersed in the liquid of the receiving reservoir of the liquefier. The efficiency was found to be the same for the two arrangements. The author concludes that, in the modified liquefier, liquefaction must have taken place before the air reached the expansion valve and that therefore the Thomson-Joule effect was eliminated. The theory of the cycle in the modified liquefier is discussed and suggestions are made for improving the efficiency of liquefiers. C. A. KRAUS.

**Precooling in the Liquefaction of Air.** BY W. P. BRADLEY AND G. P. O. FENWICK. *J. Physic. Chem.* **10**, 275-289.—The subject-matter of this paper is the same as that of the paper just reviewed and the experimental results are essentially the same. When the air was cooled before reaching the interchanger, the efficiency was greatly increased; in fact, it was found to be about twice as great, as was to be expected by application of Schrötter's formula. With internal cooling, in which the air was cooled to liquid air temperatures just before the expansion valve was reached, no change in efficiency resulted. The authors point out the difficulty of harmonizing these results with the view that the production of cold at the expansion valve is due to the Thomson-Joule effect. On the other hand, the differences due to internal and external cooling remain to be reconciled. When the blast from the expansion valve was conducted through a separator, a gain in efficiency of 4 per cent. was obtained.

C. A. KRAUS.

**The Tensile Strength of Copper-tin Alloys.** BY E. S. SHEPHERD AND G. B. UPTON. *J. Physic. Chem.* **9**, 441-476.—This paper gives an account of an extended study of the mechanical properties of copper-tin alloys between 100 and 70 per cent. of copper. In planning the experiments as well as in analyzing the results, the copper-tin diagram was referred to. The test pieces were chill-cast in graphite moulds, and, in general, no machining was necessary to reduce them to the proper dimensions, which were 0.42 inch diameter and 3 inches length of cylinder. Numerous precautions had to be taken to insure reliable castings, particularly

in the range from 94 to 87 per cent. copper. As it was, some results had to be rejected. Tests on the ultimate tensile strength and per cent. of elongation were carried out for interval of composition of 2 or 3 per cent. for the most part. Tests were made on specimens as follows: (1) directly after casting, (2) after being heated for a week at  $540^{\circ}$  and then quenched in water, (3) after being heated for a week at  $400^{\circ}$  and then slowly cooled, and (4) after being brought to a medium red heat and quenched. From 100 to 87 per cent. copper the heat treatment had little effect on the ultimate strength of the alloy. From 87 to 76 per cent. marked differences appear. Treatment (3) gives the weakest casting, while the other treatments gave increasing strength in the order (1), (2), (4). At 81 per cent. the strength for treatment (3) was found to be 43,000 pounds per square inch, while for (4) it was found to be 63,000 pounds. The general result is therefore that annealing below red heat tends to lessen the strength. The differences found between quenching from  $540^{\circ}$  after a week's heating and from red heat after brief heating, are probably due to a coarser crystalline structure in the former. In the neighborhood of 80 per cent. copper the maximum strength is reached, after which the strength falls off abruptly so that at 70 per cent. it lies below 20,000 pounds and is very uncertain, being almost zero in some cases. As regards ductility (per cent. elongation) those pieces tested immediately after casting exhibit a slight maximum at 98 per cent. At this composition specimens subjected to other treatment exhibit a slightly higher ductility. Beyond this composition the test pieces annealed for a week at  $400^{\circ}$  and  $540^{\circ}$  show increasing ductility which reaches a maximum at about 87 per cent., the per cent. elongation reaching 39 per cent. for pieces annealed at  $540^{\circ}$ . Beyond 87 per cent. the ductility falls off rapidly. Stress and strain curves were obtained for a number of compositions. Whatever the treatment, the curves rise regularly and show no signs of a point of maximum load as do iron and steel.

C. A. KRAUS.

**On the Theory of Experiments to Aberrations of the Second Degree.** BY EDWARD W. MORLEY AND DAYTON C. MILLER. *Phil. Mag.* 9, 669-689.—The negative results obtained by Michelson and Morley in their experiments on the relative motion of ether and matter have recently been discussed by Dr. Hicks. This paper throws some doubt on the result of the experiment mentioned. Accordingly, the authors discuss the theory of these experiments with the result that one of the expressions entering into the computations of Dr. Hicks is found to be not sufficiently approximate. On introducing the proper correction, the earlier theory is found to be essentially correct.

C. A. KRAUS.

**Report of an Experiment to Detect the Fitzgerald-Lorentz Effect.** BY EDWARD W. MORLEY AND DAYTON C. MILLER. *Phil.*

*Mag.* 9, 680-685.—To explain the negative result of Michelson and Morley's experiment on the drift of the ether in the neighborhood of the earth's surface, FitzGerald and Lorentz suggested that the motion of translation of a solid through the ether produces contraction of the solid in the direction of motion and extension at right angles to this direction, this change in dimensions being such as to annul the optical effect which would otherwise be observed. It may be possible that the amount of compression is a function of the material employed, in which case a positive result might be observed if the sandstone block, used for mounting the optical system by Michelson and Morley, were replaced by some other material. Experiments were accordingly carried out with two mountings, one being built up of white pine, the other of steel. In both cases negative results were obtained. If there is an effect of the nature expected, it is less than the hundredth part of the computed value. If the ether near the apparatus did not move with it, the difference in velocity was less than 3.5 kilometers per second, unless the effect on the materials annulled the effect sought. C. A. KRAUS.

**Thermo-Electric Determination of Temperatures between 0° and 200° Centigrade.** BY A. DE FOREST PALMER, JR. *Physic. Rev.* 21, 65-79.—With a view to the practical measurement of temperatures between 0° and 100° by means of a thermo-electric junction, the author investigated the properties of a junction between iron and a metal supplied by the Driver-Harris Wire Co., of Harrison, N. J., under the trade name "Advance." The approximate composition of this metal was found to be 55 per cent. copper, 44.4 per cent. nickel and 0.6 per cent. iron, and agrees closely in both composition and properties with the metal constantin. As constant temperatures were chosen; melting ice, the transition point of sodium sulphate, and the boiling-points of water, benzene, chlorobenzene, and aniline. If

$$\theta = 100 \frac{V_T}{V_{100}},$$

where  $V_T$  and  $V_{100}$  represent the electromotive forces when the iron-advance junction is maintained at the air thermometer temperatures  $T^\circ$  and  $100^\circ$  and the copper-advance junctions are kept at the temperature of melting ice, and  $\theta$  is thermo-electric temperature of the hot junction, then the true temperature  $T$  may be obtained by means of the empirical equation

$$T = \theta + D$$

when

$$D = \theta(\theta - 100)(116 \theta \times 10^{-8} - 4912 \times 10^{-7}).$$

The constants,  $116 \times 10^{-8}$  and  $4912 \times 10^{-7}$ , were determined from the transition temperature of sodium sulphate and the boiling-point of aniline. The author considers that the junction



gives results with slightly less accuracy than does a properly constructed and carefully calibrated mercury thermometer, but that it is superior to the mercury thermometer as regards freedom from corrections and convenience in handling.

C. A. KRAUS.

**The Osmotic Pressure and the Depression of the Freezing-Points of Solutions of Glucose.** Part I. BY H. N. MORSE, J. C. W. FRAZER AND B. S. HOPKINS. *Am. Ch. J.* **36**, 1-39.—

In an earlier paper (*this Rev.* **11**, 537), in which the results of osmotic pressure measurements on solutions of cane-sugar were communicated, attention was called to certain sources of error which might be eliminated. In the present communications the authors describe in detail the improvements which have been made in their apparatus, which was used in measurements with solutions of glucose as well as with solutions of cane-sugar. A thermostat with a large bath, and an air space above it at the same temperature as the bath, were used to secure uniform temperature of the cells and of the manometers. A further air space was enclosed around the thermostat and its temperature automatically regulated, and finally the temperature of the room could be automatically regulated in severe weather. As in previous measurements, the cells were freed from air by electrical endosmose before precipitating the membrane. Since the cells now used are very dense, the flow of liquid through them is very slow. Formerly, potassium sulphate was added to the water used in washing the cells, but it has been found that with the substitution of lithium sulphate in place of the potassium salt the flow is considerably increased. Preliminary results indicate that the quantities of water carried through a porous wall, other things being equal, are inversely proportional to the relative velocities of the cations divided by the valence of the cations respectively. The authors lay stress on the necessity for subjecting the cells repeatedly to the membrane-forming process, as well as to osmotic tests in which the membrane-forming materials, potassium ferrocyanide and copper sulphate, are added to the solution and the solvent respectively. The resistance of the cells serves as an indicator of their condition of serviceability, the membrane formation being continued until the resistance reaches a maximum which may be as high as 300,000 ohms. The behavior of the cells in actual use varies very considerably with the individual nature of the cell. In some cases the maximum of osmotic pressure is established in the course of a few hours while in others it may require a day or more. The higher the resistance of the cell the more rapidly does the pressure maximum establish itself. The concentration of the solution seems to have no influence on the time required to establish the pressure maximum. On the other hand, the nature of the dissolved substance

does have considerable influence. Solutions of glucose reach their pressure maximum much more slowly than solutions of cane-sugar. It is pointed out that a solution in a cell with a leaky membrane may exhibit a nearly constant pressure for a long time which may readily be mistaken for the true pressure maximum, if the experimenter lacks experience. The results obtained with solutions of glucose are to follow in Part II of this paper.

C. A. KRAUS.

**A Redetermination of the Osmotic Pressure and of the Depression of the Freezing-Points of Cane-Sugar Solutions.** By H. N. MORSE, J. C. W. FRAZER, E. J. HOFFMAN AND W. L. KENNON. *Am. Ch. J.* **36**, 39-93.—With the improved apparatus, described in the preceding review, a redetermination of the osmotic pressure of solutions of cane-sugar was undertaken. The principal corrections applied are for inversion of the cane-sugar and for dilution of the solution, owing to displacement of the rubber stopper used in closing the cell. The calculated molecular weights are referred to hydrogen taken as unity. Concentrations are referred to the weight-normal unit, and at least two independent determinations were made at each concentration, which varied from 0.1 to 1.0 normal by steps of 0.1. The theoretical molecular weight of cane-sugar is 339.6. The mean of all the experimental results gives the value 337.59, differing from the theoretical value by 0.59 per cent. If the results at 0.1 normal, which are unaccountably lower than was to be expected, are excluded, the average molecular weight is found to be 338.82 or 0.23 per cent. lower than the theoretical value. The results of this paper therefore confirm the results previously obtained, viz., that "*cane-sugar in aqueous solutions exerts an osmotic pressure equal to that which it would exert if it were gasified at the same temperature, and the volume were reduced to that of the solvent in the pure state.*" It was shown in the earlier communication that the depression of the freezing-points of cane-sugar solutions conform to the empirical rule

$$\Delta_1 = 1.85 ND = \Delta$$

for all concentrations, where  $\Delta_1$  represents the calculated depression,  $\Delta$  the observed depression,  $N$  the weight-normal concentration, and  $D$  the density of the solution. More careful investigations have confirmed this result over a range of concentrations from 0.1 normal to 1.0 normal. It is pointed out that while the depressions of the freezing-point of cane-sugar solutions are not proportional to the concentrations, the osmotic pressures, as measured at ordinary temperatures, are strictly normal. If the abnormal freezing-point depressions are due to association of the solvent with the dissolved substance, as is sometimes assumed, the osmotic pressures should be similarly affected. The discrepancy might be explained by assuming

that at the temperatures at which the osmotic pressures were measured the association has disappeared. This will be tested by making measurements of the osmotic pressure at  $0^{\circ}$ . It is stated that the freezing-points of solutions of glucose are normal, *i. e.*, the depression is proportional to the concentration.

C. A. KRAUS.

**The Conductivity and Viscosity of Solutions of Certain Salts in Mixtures of Acetone with Methyl Alcohol, with Ethyl Alcohol and Water.** BY HARRY C. JONES AND EUGENE C. BINGHAM. *Am. Ch. J.* **34**, 481-554.—The authors have determined the fluidities of mixtures of acetone with methyl and ethyl alcohols, and water containing 25, 50 and 75 per cent. of acetone, and they have measured the conductivities of potassium iodide, lithium nitrate, and calcium nitrate in these mixtures as well as in the pure solvents. The conductivity of potassium iodide in mixtures of acetone and the alcohols varies linearly with the amount of acetone, while in mixtures of acetone and water the conductivity exhibits a pronounced minimum. On the other hand, the conductivity of calcium and lithium nitrates exhibits a pronounced maximum in mixtures of acetone and the alcohols, while in mixtures of acetone and water it exhibits a minimum which is the less pronounced the greater the concentration of the salt. In the mixtures of acetone and the alcohols the maximum is displaced toward lower percentages of acetone as the concentration of the salt increases, while the minimum in mixtures of acetone and water is not appreciably displaced by concentration. The authors find that the fluidity curve of mixtures of acetone and the alcohols is practically a straight line, while for mixtures of acetone and water the fluidity curve exhibits a pronounced minimum. The form of the fluidity curve is not changed by adding a salt. They point out that the "normal" form of fluidity curve should be a straight line, from which it follows that the "normal" form of viscosity curve is an hyperbola and not a straight line as has often been assumed. From a comparison of the conductivity and fluidity curves it follows that the conductivity curve of potassium iodide runs parallel to the viscosity curve for mixtures of acetone with water as well as with the alcohols. In the case of calcium and lithium nitrates no such relation exists for mixtures of acetone and the alcohols. The displacement of the conductivity maximum with concentration as well as the behavior of potassium iodide makes it probable that the conductivity maximum is not due to increased dissociation, and the authors are inclined to ascribe this behavior to changes in the solvent envelope surrounding the ions.

C. A. KRAUS.

**A Study of the Temperature Coefficients of Conductivity in Aqueous Solutions and on the Effect of Temperature on Dissociation.** BY HARRY C. JONES AND AUGUSTUS P. WEST. *Am.*



*Ch. J.* **34**, 357-422.—With a view to determining how the dissociation of a large number of salts varies with the temperature, conductivity measurements were carried out at four temperatures with  $0^{\circ}$  and  $35^{\circ}$  as limits. Measurements were made in glass vessels with platinum electrodes, by the Kohlrausch method. The water employed in making up the solutions had a conductivity of  $1.5$  to  $2.0 \times 10^{-6}$  and the results are corrected for this conductivity of the solvent in the usual way. The final results are given in tabular form along with the average increase of conductivity (in Kohlrausch units) per degree, the average percentage increase of conductivity per degree, and the degree of dissociation calculated from the conductivities. It was found that the dissociation of all substances examined decreases slightly with increasing temperature, while the percentage temperature coefficient decreases. The increase in conductivity per degree, however, increases for the salts and decreases for the acids with rising temperature. The symbols adopted in the expressions for the temperature coefficients are somewhat ambiguous. Since no distinction is made between  $t$ , temperature, used as a subscript and as a numerical factor.

C. A. KRAUS.

**The Approximate Composition of the Hydrates Formed by a Number of Electrolytes in Aqueous Solutions; Together with a Brief General Discussion of the Results Thus Far Obtained.** (Thirteenth Paper.) BY HARRY C. JONES AND H. P. BASSETT. *Am. Ch. J.* **34**, 290-349.—Some further results are communicated relative to the effect of hydrated salts on the color of solutions of certain salts, such as cobalt chloride, cupric bromide, etc. (*this Rev.* **11**, 556). Data relating to the influence of temperature on the hydration of salts separating from solution are collected in tabular form. From this it appears that, for salts which crystallize with varying amounts of water of crystallization, the higher hydrates appear at lower temperatures. Further measurements have been carried out on the specific gravities, conductivities, and freezing-points of concentrated solutions, from which the degree of hydration of the dissolved substance is calculated by the method previously employed. A large number of compounds were studied, including salts, acids, and bases. In harmony with previous work, it was found that compounds exhibit a degree of hydration in solution which run parallel with the amount of water of crystallization with which they combine on separating from solution. Disodium phosphate, crystallizing with 12 molecules of water, is hydrated to the extent of 138 and 334 molecules of water per molecule of salt, in solutions containing 0.10 and 0.05 gram-molecules per liter, respectively. In general, the total amount of water, in combination with the dissolved substance, increases with the concentration, while the number of molecules of water in combination with 1 molecule of

the dissolved substance, decreases with increasing concentration. In certain cases, however, as with the more common acids, the amount of water in combination with 1 molecule of the dissolved substance is practically zero in dilute solutions, increasing and passing through a maximum with increasing concentration.

C. A. KRAUS.

**The Infra-Red Spectrum of  $\text{CO}_2$  and Nitrogen.** BY E. R. DREW. *Physic. Rev.* **21**, 122-128.—In the radiations from the positive columns of a Geissler-tube discharge in air, the author observed a band at  $4.75\mu$ . He seeks to determine if this band is due to nitrogen or to the known band in carbon dioxide at  $4.4\mu$ , which has suffered displacement, due to temperature or pressure. Since a band was found in carbon dioxide at  $4.70\mu$  which is displaced by pressure, while the band in nitrogen or air was found at  $4.70\mu$  and is not displaced by pressure, the conclusion is drawn that the band observed in nitrogen or air is not due to carbon dioxide.

C. A. KRAUS.

**The Evolution of Hydrogen from the Cathode and Its Absorption by the Anode in Gases.** BY CLARENCE A. SKINNER. *Physic. Rev.* **21**, 1-15.—In studying the electrical discharge through helium tubes, it was found that a considerable amount of hydrogen is evolved from the electrodes. On quantitative investigation it was found that with various metallic cathodes in helium, at a pressure of a few millimeters, the amount of hydrogen evolved is proportional to the quantity of electricity passed through the tube and, moreover, this amount is very nearly that required by Faraday's law. Similarly, it was found that hydrogen is absorbed by the anode according to the same law when a discharge is passed between metal electrodes in an atmosphere of hydrogen. The reason why the evolution of gas is more pronounced in a tube of helium is because the helium is not absorbed by the anode, while the hydrogen is not appreciably absorbed so long as it is present in small amount. In all cases the relations found hold true only for the first few minutes during which the discharge passes. The author draws the conclusion that during the first few minutes the current passes out of the cathode entirely by an ionic process, the carriers being negatively charged ions of hydrogen.

C. A. KRAUS.

**The Evolution of Nitrogen from the Cathode and Its Absorption by the Anode in Gases.** BY CLARENCE A. SKINNER. *Physic. Rev.* **21**, 169-180.—The author extends his investigations on the absorption and evolution of gases by the electrodes (preceding review) to nitrogen. In this case carbon electrodes were employed in an atmosphere of helium. The results obtained are in accord with those previously obtained with hydrogen. The bearing of these results on the mechanism of the process

involved in the passage of the current from metal to gas is discussed.

C. A. KRAUS.

### The Atomic Weight of Radium and the Periodic System.

BY HARRY C. JONES. *Am. Ch. J.* **34**, 467-471.—By chemical methods Mme. Curie has found for the atomic weight of radium the value 225, while Runge and Precht have found the value 258, from certain relations among the spectral lines of this element. The author adduces various arguments in favor of the higher value. He considers that the lower value is not in keeping with the activity of the element, since the activity should increase with increasing atomic weight, for which reason its atomic weight should be higher than that of uranium and thorium. To account for its relations to barium he would place radium in a new series, 13, in group II. To account for the proportionality between the amounts of radium and uranium present in minerals the author adopts a suggestion of Joly's according to which, radium is not formed directly from uranium but is the result of reaction between a decomposition product of uranium and some of the elements present in the mineral.

C. A. KRAUS.

### Some Physical Properties of Current-Bearing Matter—III.

**Boiling-Point.** BY PAUL R. HEYL. *Physic. Rev.* **21**, 189-192.—The author seeks to determine if the boiling-point of matter is affected by an electric current. Mercury, copper sulphate and acetic acid were examined, with negative results.

C. A. KRAUS.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**The Statistical Method in Chemical Geology.** BY F. W. CLARKE. *Pr. Am. Phil. Soc.* **45**, 14-32.—“The composition of the lithosphere has furnished, so to speak, a sort of base-line to which other computations could be referred; the figures, therefore, have acquired a peculiar importance, and it has become desirable to determine, more critically than heretofore, the degree of their validity. To discuss the nature of the averages and to consider how far they may be utilized is the purpose of the present communication.” A new computation (basal data here omitted) of the composition of the outer 10-mile shell of the lithosphere, allowing 95 per cent. to the igneous rocks, 4 per cent. to the shales, 0.75 per cent. to the sandstones, and 0.25 per cent. to the limestones, leads to:  $\text{SiO}_2$ , 59.79;  $\text{Al}_2\text{O}_3$ , 14.92;  $\text{Fe}_2\text{O}_3$ , 2.63;  $\text{FeO}$ , 3.33;  $\text{MgO}$ , 3.98;  $\text{CaO}$ , 4.82;  $\text{Na}_2\text{O}$ , 3.28;  $\text{K}_2\text{O}$ , 2.96;  $\text{H}_2\text{O}$ , 1.98;  $\text{TiO}_2$ , 0.71;  $\text{ZrO}_2$ , 0.03;  $\text{CO}_2$ , 0.74;  $\text{P}_2\text{O}_5$ , 0.25;  $\text{S}$ , 0.10;  $\text{SO}_3$ , 0.02;  $\text{Cl}$ , 0.07;  $\text{F}$ , 0.02;  $\text{BaO}$ , 0.10;  $\text{SrO}$ , 0.04;  $\text{MnO}$ , 0.09;  $\text{NiO}$ , 0.03;  $\text{Cr}_2\text{O}_3$ , 0.05;  $\text{V}_2\text{O}_3$ , 0.02;  $\text{Li}_2\text{O}$ , 0.01;  $\text{C}$ , 0.03; total, 100.00. Combining the lithosphere (93 per cent.), the ocean (7 per cent.), and including



the atmosphere, the following average composition expressed in elementary form for the outer shell of the earth with its gaseous envelope is derived: O, 49.77; Si, 26.08; Al, 7.34; Fe, 4.11; Ca, 3.19; Mg, 2.24; Na, 2.33; K, 2.28; H, 0.95; Ti, 0.39; C, 0.18; Cl, 0.21; P, 0.10; S, 0.10; Ba, 0.09; Mn, 0.07; Sr, 0.03; N, 0.02; F, 0.02; all others, 0.50; total, 100.00. "It would be foolish to ascribe any high degree of accuracy to these figures, for the data are confessedly of very unequal value. They do show, however, clearly and conclusively, the order of magnitudes with which we have to deal." Warning is uttered against too free application of the chemical data now available in the computation of geochemical problems. New material is needed and some of the desiderata are indicated by the author.

W. F. HILLEBRAND.

**On Two New Occurrences of the "Cortlandt Series" of Rocks within the State of Connecticut.** BY W. H. HOBBS. *Festschrift Harry Rosenbusch, gewidmet von seinen Schülern zum siebzigsten Geburtstag, 24 Juni, 1906.* (E. Schweizerbartsche Verlagsbuchhandlung, Stuttgart). Pp. 25-48; plate, figures.—The first and more important of the occurrences is at Prospect Hill, about five miles west of Litchfield, the other in a narrow strip extending about six miles north-northwesterly from Danbury. Rocks of the following types are described: Gabbroitic, noritic, olivine hypersthene gabbro, dioritic, peridotite, pyroxenite, grano-diorite, of which all but the third and last are represented by analyses by either W. F. Hillebrand or Geo. Steiger. Definite contact phenomena are absent. To explain the differentiations observed. "The view held by the writer is then that the generally rare gabbro, norite, peridotite, and pyroxenite types which most nearly correspond to the original 'Cortlandt Series,' belong to a single magma which has here been intruded along the borders of areas of granite, grano-diorite and diorite, which may themselves have mingled to some extent; and that it has itself been later intruded by a fine-grained diorite. The extreme magmatic differentiation of this gabbroitic magma has been locally increased through the fusion with it of granite and grano-diorite."

W. F. HILLEBRAND.

**The Differentiation of a Secondary Magma through Gravitational Adjustment.** BY R. A. DALY. *Festschrift Harry Rosenbusch, etc.,* pp. 203-233; figures.—This is a further contribution to a theory of magmatic differentiation in substantiation of earlier arguments of the author, based on observations in the Purcell Mountain Range along the 49th parallel of latitude between Port Hill, Idaho, and Gateway, Montana, where is shown "an exceptionally clear example of differentiation within a magmatic chamber, the crystallized contents of which can now be examined from top to bottom of the chamber." Numerous analyses by M.

Dittrich and one by M. J. Connor are used in support of the author's views.

W. F. HILLEBRAND.

**On Octahedrite, Brookite and Titanite from Somerville, Massachusetts, U. S. A.** By C. PALACHE. *Festschrift Harry Rosenbusch*, etc., pp. 311-321; figures.—The principal points of interest are: "(1) The addition of a new locality for well-crystallized octahedrite, brookite and titanite to the very brief list of occurrences of these minerals hitherto known in America. (2) The recognition for the first time of twin structure in octahedrite. Twinning law. Interpenetration with (101) as twin plane. (3) The alteration of brookite to sagenitic aggregates of rutile. (4) The occurrence in intimate association of four compounds of titanium, octahedrite, brookite, titanite, and (as secondary product) rutile."

W. F. HILLEBRAND.

**The Plauenal Monzonose (Syenite) of the Plauenscher Grund.** By H. S. WASHINGTON. *Am. J. Sci.* **22**, 129-135.—Re-analysis of this very typical and longest known representative of the syenites proper has shown that the older analyses were almost beyond doubt defective, especially as to the relative proportions of the alkalis. The mean of Washington's analyses of material from different parts of the rock mass shows:  $\text{SiO}_2$ , 60.60;  $\text{Al}_2\text{O}_3$ , 16.79;  $\text{Fe}_2\text{O}_3$ , 2.77;  $\text{FeO}$ , 2.17;  $\text{MgO}$ , 2.14;  $\text{CaO}$ , 4.47;  $\text{Na}_2\text{O}$ , 4.40;  $\text{K}_2\text{O}$ , 4.57;  $\text{H}_2\text{O}+$ , 0.61;  $\text{H}_2\text{O}-$ , 0.25;  $\text{TiO}_2$ , 0.90;  $\text{P}_2\text{O}_5$ , 0.28;  $\text{BaO}$ , 0.15;  $\text{SrO}$ , trace;  $\text{MnO}$ , not determined, no  $\text{CO}_2$ ,  $\text{ZrO}_2$ ,  $\text{SO}_3$ , S; total, 100.10. Sp. gr. 2.73. In the quantitative system of classification the rock is in a general way a hornblende grano-monzonose, but the name plauenal monzonose may be appropriately assigned to it because of its typical character. It is fully described in terms of the quantitative system.

W. F. HILLEBRAND.

**Notes on Some Eruptive Rocks of Mexico.** By F. N. GUILD. *Am. J. Sci.* **22**, 159-175; figures.—The rocks described are mostly from or near the valley of Mexico, which is surrounded by enormous eruptive masses composed of andesites and basalts similar in character and variety to those found elsewhere in Mexico. Hypersthene andesites (tonalose and tonalose-andose) are described from Popocatepetl and Sierra de Guadalupe, and the former are represented by two analyses. A hornblende andesite (tonalose) from Colima de Chapultepec is also represented by an analysis, as likewise a basal (comptonose) from El Salto de San Anton. The rocks are fully described in terms of the quantitative system of classification, and the similarity of the hypersthene andesites to those from Crater Lake, Oregon, Mt. Shasta, California, Buffalo Peaks, Colorado, and elsewhere is pointed out. The identical chemical composition of rocks with quite different mineralogical

development is also mentioned. The analyses show the growing importance attached to thoroughness in detail.

W. F. HILLEBRAND.

**Coal Fields of the Kachemak Bay Region.** BY RALPH W. STONE. *Mineral Resources of the Kenai Peninsula, Alaska.* U. S. Geol. Survey, Bull. 277, pp. 53-73; map, plates.—The coals are lignites, the average of six analyses of samples from as many localities, by W. T. Schaller, showing: Moisture, 19.85; volatile combustible matter, 40.48; fixed carbon, 30.99; ash, 8.67; sulphur, 0.35. The earlier analyses published by Dall in 1895 were defective because the samples had lost much of their moisture between collecting and analyzing. There is also an analysis of Port Graham coal.

W. F. HILLEBRAND.

**Slate Deposits and Slate Industry of the United States.** BY T. NELSON DALE, with sections by E. C. ECKEL, W. F. HILLEBRAND AND A. T. COONS. U. S. Geol. Survey, Bull. 275, 154 pp.; maps, plates, figures.—Part I is devoted to the origin, composition and structure of slate; Part II to the slate deposits of the United States. A bibliography and brief glossary of geological and slate-quarrying terms conclude the report.

W. F. HILLEBRAND.

**Description of the Snoqualmie [Washington] Quadrangle.** BY G. O. SMITH AND F. C. CALKINS.—Descriptive text accompanying the *Snoqualmie Folio No. 139 of the Geological Atlas of the U. S.* issued by the Geol. Survey. Accompanying the geological descriptions are analyses by G. Steiger of Kachees rhyolite, Keechelus hypersthene-andesite, Keechelus basalt, and Snoqualmie grano-diorite. There are also analyses from other hands of Roslyn coals and of a low-grade iron ore of unusual derivation from "iron buttes" on Clealum river.

W. F. HILLEBRAND.

**Description of the Redding [California] Quadrangle.** BY J. S. DILLER.—Descriptive text accompanying the *Redding Folio, No. 136 of the Geological Atlas of the U. S.* issued by the Geol. Survey. The sedimentary and igneous formations and the economic resources are described at some length.

W. F. HILLEBRAND.

**Preliminary Report on the Geology and Underground Waters of the Roswell Artesian Area, New Mexico.** BY CASSIUS A. FISHER. U. S. Geol. Survey, *Water Supply and Irrigation Paper No. 158*, 29 pp.; maps, plates.—Contains a number of analyses by E. M. Skeats of waters from springs in North and South Spring rivers, from artesian wells at Roswell, and from the larger western tributaries of the Pecos river.

W. F. HILLEBRAND.

**Bibliographic Review and Index of Underground-Water**



**Literature Published in the United States in 1905.** BY M. L. FULLER, F. G. CLAPP AND B. L. JOHNSON. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 163*, 130 pp.

W. F. HILLEBRAND.

**A Preliminary Report on the Peat Resources of Iowa and a Report on the Tests of Iowa Coals Made by the Government Coal-Testing Plant at the Louisiana Purchase Exposition, St. Louis, Mo., 1904.** BY T. E. SAVAGE. *Iowa Geol. Survey, Bull. 2*, 40 pp.; map.—The coal tests referred to are among those detailed in Professional Paper No. 48 of the U. S. Geol. Survey (this Journal, 28, R 241).

W. F. HILLEBRAND.

**Three New Chilian Meteorites.** BY HENRY A. WARD. *Pr. Rochester Acad. Sci. 4*, 225–231; plates.—*Ilimaes*. An interesting pallasite, appertaining to the Rokicky group and found in 1874 or 1875 in the desert of Atacami, about 12 leagues south of Taltal. Now in the Lyceo at Copiapo. Weight 95 kilos. *Cobija*. Found in 1892 on the Pampa of Santa Barbara, Antofogasta, a short distance eastward from Cobija. A crystalline chondrite (Ck). Original weight 3690 grams. Largest remaining piece at the School of Mines, Santiago. *Chanaral*. A siderite, weight 1207 grams, likewise in the School of Mines, Santiago. Found in 1884 on the Atacama desert, not far from Chanaral. Nickel, 5.37; iron, 95.97 per cent. Classed as a medium octahedrite.

W. F. HILLEBRAND.

**The Mining and Quarry Industry of New York State, Report of Operations and Production during 1905.** BY D. H. NEWLAND. *Bull. 102, New York State Mus.*, 199 pp.—This bulletin is similar to the one issued in 1905, but its scope has been somewhat enlarged and the treatment is in some parts more comprehensive. Some analyses supplement the text, particularly that part relating to the magnetic iron ores of the Adirondack region.

W. F. HILLEBRAND.

**The Copper Deposits of the Robinson Mining District, Nevada.** BY ANDREW C. LAWSON. *Bull. Dept. Geol., University of California*, Vol. 4, No. 14, pp. 287–357.—The mineralization of the district is intimately and genetically connected with an irregular intrusion into carboniferous rocks of a porphyry—a very much kaolinized, silicified, carbonated and pyritized rhyolite. There are three well-marked zones: (1) in the porphyry, containing pyrite and chalcocite; (2) in the limestones below the porphyry, carrying gold; (3) in the limestones above the porphyry, carrying argentiferous galena with subordinate zinc and copper minerals. The chief interest now centers in the copper deposits in the porphyry, which owe their value in part to secondary enrichment by downward leaching from a well-defined zone of oxidation in

the upper part of the porphyry. In this connection the author shows experimentally that ferrous sulphate solution in presence of air will dissolve copper as cupric sulphate from a mixture of chalcocite and porphyry. There are several rock analyses, by H. Ross, including monzonites, the ore-bearing porphyry, and a corundiferous minette; and the following analysis of mine-water at the Ruth mine, by H. E. Miller, is given as an indication of the materials which are being leached from the porphyry by the descending meteoric waters:  $\text{SiO}_2$  + insoluble matter 5.50 grains per U. S. gallon;  $\text{NaCl}$ , 4.88;  $\text{KCl}$ , 0.55;  $\text{FeSO}_4$ , 5.77;  $\text{Fe}_2(\text{SO}_4)_3$ , 8.78;  $\text{K}_2\text{SO}_4$ , 2.96;  $\text{CaSO}_4$ , 20.99;  $\text{MgSO}_4$ , 7.61; organic matter + water of sulphates, 6.96; total, 64.00. Another sample analyzed immediately after collection gave:  $\text{FeSO}_4$ , 9.36;  $\text{Fe}_2(\text{SO}_4)_3$ , 0.4.

E. C. SULLIVAN.

**The Occlusion of Igneous Rock within Metamorphic Schists, as Illustrated on and near Manhattan Island, New York.** BY ALEXIS A. JULIEN. *Annals N. Y. Acad. Sci.* 16, 387-446.—The author discusses the mechanical and chemical changes accompanying occlusion, the envelopment of a foreign fragment in a rock-mass, and describes, in detail, occurrences of that nature.

E. C. SULLIVAN.

**A Remarkable Soda Spring.** BY J. A. EDDY. *Eng. Min. J.* 81, 793; *J. Franklin Inst.* 162, 24.—The water of this spring from unnamed locality in New Mexico contains per gallon 3.13 pounds solids, of which 83 per cent. is sodium sulphate. Its temperature is slightly above  $110^\circ\text{F}$  ( $43^\circ\text{C}$ ). On flowing and cooling it solidifies to crystalline hydrated sodium sulphate, which slowly gives up its water by efflorescence. Through this deposit, miles in extent, the spring, by reason of its heat, maintains its channel.

E. C. SULLIVAN.

**The Occurrence of Stibnite at Steamboat Springs, Nevada.** BY WALDEMAR LINDGREN. *Trans. Am. Inst. Min. Eng.* 36, 27.—Small crystals of stibnite, evidently deposited by the water of the hot springs, were found adhering to gravel pebbles.

E. C. SULLIVAN.

**The Helen Iron Mine, Michipicoten [Ontario].** BY ARTHUR P. COLEMAN. *Economic Geology* 1, 521-529.—The ore is mainly limonite with a little red hematite. It contains in unexpected places masses of pyritic sand. The rocks with which it is associated are a mixture of siderite with pyrite and quartz and a banded siliceous rock poor in iron. The siderite and pyrite, transformed by acids and oxygen, seem to have been the chief sources of the ore.

E. C. SULLIVAN.

**Metasomatic Processes in the Gold Deposits of Western Australia.** BY WALDEMAR LINDGREN. *Economic Geology*, 1,

530-544.—Three modes of occurrence of gold are distinguished in this region: (1) in hematite-bearing quartzites, (2) in quartz veins which usually occur in amphibolite or along the contact of granitic rocks and amphibolite, (3) in replacement deposits usually continuous with the surrounding rock and of similar origin but distinct from it in carrying metallic ores in paying quantities. "Of minerals associated with the native gold, tellurides prevail, and among these calaverite and coloradoite are the most common." The metasomatic processes have transformed an amphibole-chlorite-zoisite-albite rock into a quartz-sericite-albite-carbonate rock. Analyses show that potassium has in part replaced sodium, and that carbon dioxide, sulphur, gold, mercury and tellurium have been introduced; carbonates have been developed at the expense of the lime, magnesia and iron contained in the chlorite and amphibole, and pyrite at the expense of the same minerals and the black iron ores. These processes are almost identical with those which have taken place in California and at Cripple Creek, a fact which the author considers "points to a remarkable similarity of gold-bearing solutions throughout the world." The presence of tourmaline, albite and smaller amounts of magnetite and specularite indicates that, unlike those at Cripple Creek, the veins were formed at great depth and at high pressure and temperature.

E. C. SULLIVAN.

## ANALYTICAL CHEMISTRY.

**A System of Qualitative Analysis Including Nearly All the Metallic Elements.** BY ARTHUR A. NOYES. *Ch. News.* 93, 134-136, 146-149, 156-160, 171-175, 179-181, 189-192, 205-207, 216-218, 226-227, 239-240, 250-252, 262-263 (1906).—A reprint of two articles published in the *Technology Quarterly* (16, 93-131 (1903); 17, 214-257 (1904)) and already reviewed in these columns (this Journal, 25, R 445 (1903); 27, R 264)).

A. W. BROWNE.

**Note on "The Estimation of Opalescent Silver Chloride Precipitates."** BY R. C. WELLS. *Am. Ch. J.* 35, 508 (1906).—Attention is called to an incorrect conclusion appearing in a recent article by the author under this heading. (*Am. Ch. J.* 35, 99; this Journal, 28, R 182). The time factor must indeed be taken into account in nephelometric work upon intense opalescences, but it ceases to be a major variable in the case of weak opalescences. The correction upon the atomic weight of sodium would accordingly be even less than 0.001 of a unit, and therefore entirely negligible.

A. W. BROWNE.

**Note Concerning the Use of the Nephelometer.** BY T. W. RICHARDS. *Am. Ch. J.* 35, 510 (1906).—This note was written



in order to supplement the article of R. C. Wells. (*Am. Ch. J.* **35**, 99; this Journal, **28**, R 182). The nephelometer should be employed for exact work only when the precipitate is so finely divided that it will not in any reasonable time, for example two or three days, deposit itself, and thus place itself within the range of ordinary quantitative determination. For even moderately accurate work it is essential that the unknown solutions be treated in exactly the same way as the known standard solutions, which serve as the basis of comparison.

A. W. BROWNE.

**Alcohol Calorimeter for Coal Testing.** BY W. M. WALLACE. *Am. Gas Light J.* **84**, 802 (1906).—A description of the apparatus employed by the author in a series of tests upon South African coals, for the De Beers Company, of Kimberley. The apparatus is similar in principle to the Carpenter calorimeter, and is suggested as an improvement upon this device. Two alleged sources of error inherent in the Carpenter method are pointed out. (1) The irregularity of the thermal expansion of water necessitates the invariable use of water at a certain temperature. The apparatus is, however, provided with no means of measuring the temperature of the water. A variation of  $10^{\circ}$  in the temperature of the water may make a difference of 25 per cent. in the tube readings. (2) The radiation correction is taken to be the total fall of the water in the tube after combustion, during a period of time equal to that of combustion. This, in the author's opinion, leads to a correction of nearly double the true value. The first of these difficulties may be eliminated by the use of alcohol instead of water in the calorimeter. The advantage of this modification lies not only in the fact that alcohol expands more uniformly than water, but also in the fact that it has a much larger coefficient of expansion. This permits the use of a longer graduated tube, thereby increasing the accuracy of the readings, even when smaller amounts of coal are used. Moreover, when alcohol is used, the duration of the test may be shortened. In determining the radiation correction, the author measures the rates of cooling both at the beginning and at the end of the experiment, with the oxygen flowing in each case. Fixed to the apparatus is a tube for the collection of the gaseous products of combustion, which may be measured and analyzed in a few minutes. It is asserted that a determination of the calorific value, as well as of the ash, water, carbon and hydrogen of a coal can be made with this apparatus in half an hour.

A. W. BROWNE.

**The Combustion of Halogen Compounds in Presence of Copper Oxide.** BY CHARLES J. ROBINSON. *Am. Chem. J.* **35**, 531.—A cartridge was made by rolling a small piece of heavy copper wire gauze into the form of a hollow cylinder 6 or 7 cm. long and just fitting the combustion tube. The cylinder was

filled with pure lead chromate, the ends closed by wrapping with copper wire, which also passed lengthwise through the cartridge with a loop at each end to facilitate removal from the tube. The copper parts were oxidized by ignition. When it was desired to analyze halogen compounds, this cartridge was placed just in front of the boat, in a combustion tube filled in the ordinary way with copper oxide. In burning, care was taken that the part of the tube containing the cartridge was well heated before the decomposition of the substance began, but no other special precautions were found necessary. The determination of carbon and hydrogen presents no unusual difficulties when this device is used, and in general the halogen content is not so distinctive in the identification of new compounds as the carbon and hydrogen content. Examples are given to show the accuracy of the method. Nitrogen may also be determined in halogen compounds by the use of the cartridge of lead chromate, a little lead chromate being mixed with the substance. The suggestion is made that carbon and hydrogen could doubtless be determined in sulphur compounds, using the same scheme, but no experiments have been made along that line. The same cartridge may be used a number of times, depending upon the amount of halogen taken up. The life of the combustion tube is not affected.

T. G. DELBRIDGE.

**A Recording Calorimeter for Gas. The Relation of Flame Temperature to Calorific Power.** BY J. W. BAIN AND J. W. BATTEN. *J. Chem. Ind.* **25**, 505 (1906).—The authors have made an experimental study of the relation between the flame temperature and the calorific power of a gas. In this work two gases were studied: (1) a gas made by blowing dry air through gasoline, and (2) coal gas. In either case the composition of the gas, and hence its calorific power, could be varied at will. In the latter case this end was accomplished by introducing different amounts of carbon dioxide into the gas. Simultaneous determinations were made of the flame temperature and of the calorific power, at intervals of three minutes. An apparatus consisting essentially of a Le Chatelier thermo-junction previously calibrated at the melting-points of pure tin, lead, zinc and aluminum, and enclosed in an iron tube, was used for the determination of the flame temperature; an ordinary Junker's calorimeter was used for the determination of the calorific power of the gas. The flame temperature was at first found to lag about eighteen minutes behind the calorific power. By substituting a thick paste (made of powdered silica, fire-clay and soluble glass) for the iron tube surrounding the junction, this difficulty was obviated. When a large burner was employed, and the junction placed within the flame, the flame temperature was unexpectedly found to vary inversely as the calorific power. This peculiar result was at-

tributed to the fact that the relative position of the junction in the flame was changed whenever the flame lengthened or shortened as the result of variation in the composition of the gas. The best results were obtained when the junction was raised to a position above the highest point ever reached by the flame. By using a small burner, the authors were able to obtain a series of results in which the maximum variation of flame temperature from calorific power was as low as 2 per cent. A. W. BROWNE.

## AGRICULTURAL CHEMISTRY.

### Note on the Examination of Maple Products—The Lead Value.

BY ALBERT P. SY. *J. Frank. Inst.* 162, 71-72.—The writer reviews briefly the studies of Jones, Hortvet and others in the investigation of maple products. For the determination of the lead value of maple sugars and syrups the author has modified the method of Hill and Morher and converts the lead acetate precipitate by means of hydrochloric, nitric and sulphuric acids into lead sulphate, which, after the addition of alcohol, is filtered off and the lead determined as usual. C. A. BROWNE, JR.

**Glucose.** BY C. D. HOWARD. *Sanitary Bulletin New Hampshire State Board Health*, Vol. 2, No. 12.—Special attention is given to the sulphurous acid content of glucose intended for the preparation of food products. One sample was found to be free from sulphurous acid. In the examination of 17 samples, the free sulphurous acid content varied from 0 to 0.1056 per cent., and the total sulphurous acid from 0 to 0.1888 per cent. Twenty-three samples of cheap candy were also examined with respect to the content of sulphurous acid. Two samples were found to be free of this preservative, and two to contain but traces. In one sample a "large quantity" was reported. The remaining 18 samples contained from 0.007 to 0.0576 gram of sulphurous acid in 100 grams of candy. W. D. BIGELOW.

**Report of State Analyst.** BY E. N. EATON. *Report Illinois State Food Commissioner for 1905*.—A report is submitted of 2,402 samples of foods, of which 67 per cent. were found to conform to the law. A tabular statement of the results of analyses is given. W. D. BIGELOW.

**Pure Food Rules.** BY THE KANSAS STATE BOARD OF HEALTH. *Bull. Kansas State Board Health*, Vol. 2, No. 7, p. 178.—At the annual meeting of the Kansas Board of Health, held June 21, 1906, regulations were adopted for the administration of the food law enacted by the last session of the legislature of that State.

W. D. BIGELOW.

**Report of the Food and Drug Laboratory.** BY H. E. BARNARD,



Chemist. *Monthly Bulletin Indiana State Board Health*, Vol. 8, No. 5.—The bulletin contains a detailed report of 889 samples of foods and drugs. The results of the examination of various classes of products are given in tabular form. The following is a summary of the results obtained:

## SUMMARY.

Articles examined.	Number found to be of good quality.	Number adulterated or varying from legal standard.	Total number of articles examined.	Percentage of adulteration.
Baking-powder.....	14	25	39	64.1
Beeswax, yellow.....	21	45	66	68.1
Beeswax, white.....	2	68	70	97.1
Bottled beverages.....	6	10	16	62.5
Butter.....	10	0	10	00.0
Canned fruits.....	13	0	13	00.0
Canned vegetables.....	36	19	55	34.5
Cheese.....	4	0	4	00.0
Condensed milk.....	7	1	8	12.5
Cream of tartar.....	16	5	21	23.3
Drugs, miscellaneous.....	46	9	55	16.3
Drugs, precipitated sulphur.....	0	20	20	100.0
Honey.....	25	5	30	16.6
Lard.....	6	1	7	14.2
Lemon extract.....	4	4	8	50.0
Lime juice.....	3	1	4	25.0
Maple syrup and sugar.....	20	6	26	23.0
Meat products, sausage, pressed meats, etc., fresh.....	16	34	50	68.0
Meat products, sausage, pressed meats, etc., canned.....	7	7	14	50.0
Milk.....	65	26	91	28.5
Miscellaneous flavoring extracts.....	3	20	23	86.9
Molasses.....	10	11	21	52.3
Molasses, sorghum.....	10	6	16	37.5
Olive oil.....	7	2	9	22.2
Oysters, shrimp, etc., canned.....	1	4	5	80.0
Spices.....	110	19	129	14.7
Table syrup.....	3	0	3	00.0
Tomato catsup.....	0	2	2	100.0
Vanilla extract.....	2	8	10	80.0
Vinegar, cider.....	11	25	36	69.1
Vinegar, grain.....	0	5	5	100.0
Miscellaneous food products.....	22	1	23	4.3
Totals.....	500	389	889	43.7

W. D. BIGELOW.

**The Bleaching of Flour.** By J. T. WILLARD. *Bull. Kansas State Board Health*, Vol. 2, No. 6.—Small quantities of flour are shaken with a few cubic centimeters of water and the mixture tested for nitrites by Ilosvay's modification of Griess's method. "One-half gram of sulfanilic acid is dissolved by heat in 150 cc. of dilute acetic acid. One-tenth gram of  $\alpha$ -naphthylamine is heated with 20 cc. of strong acetic acid and the colorless solution poured off from the residue and mixed with 130

cc. of dilute acetic acid. For use, the two solutions are mixed in equal quantities and 2 cc. of the mixed solution added to the liquid to be tested."

W. D. BIGELOW.

**Slaughtering- and Packing-Houses.** *Massachusetts State Board Health, Monthly Bulletin, June 1906, Vol. 1, No. 6.*—A detailed report is given of the inspection of Massachusetts slaughter-houses. All of the large establishments and a number of small slaughter-houses were examined. The larger plants, and many of the smaller ones, were found to be beyond criticism. "The great majority, however, of the small slaughter-houses examined in the rural districts are kept in anything but a sanitary condition."

W. D. BIGELOW.

**Canned Meat.** *Massachusetts State Board Health, Monthly Bulletin, June 1906, Vol. 1, No. 6.*—One hundred and fifty samples of canned meat were tested for preservatives and a microscopic examination was made. Detailed results are given.

W. D. BIGELOW.

**Fruit Preserves.** BY A. MCGILL. *Bull. 119 Lab. Inland Revenue Dept., Ottawa, Canada.*—The bulletin gives the detailed report of the examination of 182 samples of jams, jellies and marmalades. Of the entire number 97 samples were marked "compound" more or less distinctly. Of the remaining 85 which claimed to be genuine, 32 were found to be adulterated.

W. D. BIGELOW.

**Report on Foods and Drugs.** BY E. F. LADD. *Bull. 69, North Dakota Agricultural College.*—The bulletin consists of three parts. The first of these is devoted to food products and gives in tabular form a description of the various products and information as to whether they are legal or illegal, together with a statement of the deficiencies of the illegal products. In the second part of the bulletin a report on the examination of a number of samples of whisky secured in the open market in that state is given. The percentage of alcohol was found to vary from 33 to 54 per cent.; the total solids from 0.1 gram to 1.4 grams. The authorities in North Dakota require that all whisky which does not conform to the U. S. P. requirements shall be labeled "artificial." The third part of the bulletin is devoted to a report on the examination of drugs. The bulletin also contains a tabular statement, showing the improvement that has been experienced in the quality of the food on the North Dakota market since inspection was begun in 1902.

W. D. BIGELOW.

**Food Analysis.** BY F. W. ROBINSON. *Report Michigan Dairy and Food Commissioner for the year ending June 30, 1905.*—The report contains a detailed statement of the results of the

examination of 861 samples of food examined during the fiscal year ending June 30, 1905. The writer states that at the time of the presentation of the report he had been connected with the commission but three months, and credits the greater part of the work to Mr. R. E. Doolittle, his predecessor, and Mr. L. H. Van Wormer, his assistant. The detailed results of the separate analyses are given. The results of the various products are not arranged in tabular form in such a manner as to permit advantageously their comparison. A summary of the work reported is as follows:

## SUMMARY.

Article.	Total.	Not found adulterated.	Found adulterated.
Allspice .....	1	1	0
Baking-powder .....	7	7	0
Butter .....	14	4	10
Cereal preparation .....	1	0	1
Chocolates and cocoas .....	15	10	5
Cinnamon .....	5	5	0
Cloves .....	1	1	0
Coffee .....	3	2	1
Coloring powder .....	1	1	0
Corn (canned) .....	1	1	0
Cream .....	1	1	0
Cream of tartar .....	9	8	1
Extracts (flavoring) .....	82	54	28
Flour .....	3	3	0
Fruit .....	2	1	1
Ginger .....	3	3	0
Grape juice .....	1	0	1
Honey .....	5	3	2
Jellies, jams and preserves .....	40	10	30
Lard .....	1	1	0
Maple syrup .....	1	0	1
Meat .....	2	2	0
Milk .....	551	514	37
Mixtures or compounds .....	18	5	13
Molasses .....	1	1	0
Mustard .....	6	5	1
Nutmegs .....	1	1	0
Oleomargarine .....	9	3	6
Peas (canned) .....	3	3	0
Pepper .....	13	10	3
Rice .....	1	1	0
Soft drinks .....	3	3	0
Syrup .....	17	4	13
Vinegar .....	39	17	22
Totals .....	861	685	176

W. D. BIGELOW.

**Some Forms of Food Adulteration and Simple Tests for Their Detection.** BY W. D. BIGELOW AND BURTON J. HOWARD. *U. S. Dept. Agr. Bur. Chem., Bull. 100.*—The bulletin naturally divides itself into two parts. The first part consists of a non-technical statement regarding the extent, prevalence, nature,



and significance of food adulteration. The second part includes simple tests which may be used by those who have not had training in chemistry for the detection of the cruder forms of adulteration.

W. D. BIGELOW.

**The Occurrence of Barium in the Ohio Valley Brines and Its Relation to Stock Poisoning.** BY C. D. HOWARD. *West Virginia Agr. Expt. Sta., Bull. 103.*—The writer discusses the occurrence of salts of barium in the brines of the Ohio Valley and gives the results of analyses made by him of several samples of brines and spring waters from West Virginia, all of which show large amounts of barium chloride. The physiological and antiseptic value of barium chloride is discussed, and the effect upon the bacterial growth in milk is experimentally determined.

W. W. SKINNER.

**Commercial Feeding Stuffs in Pennsylvania.** BY F. D. FULLER. *Pennsylvania Dept. Agr., Bull. 145.*—The importance and benefit to the farmers of the state, of the recently enacted "Feeding Stuffs Law," are discussed, and results are given of the examination of 339 samples of commercial feeding stuffs found in the markets of Pennsylvania. The nature and effects of adulterations are discussed. Fifty-eight per cent. of those feeds requiring a guarantee failed to meet the requisitions and 127 prosecutions were brought during the year for violations of the law.

W. W. SKINNER.

**Petroleum Emulsions.** BY C. L. PENNY. *Bull. 75, Delaware Expt. Sta.*—The technique of preparing emulsions is thoroughly discussed and numerous formulae are given. The effects of the ratio of the emulsifier to the oils emulsified are considered, and low vs. high ratio treated. The character of oil used, microscopic appearance and durability of emulsions, incompatibles, markers, general methods, and cautions are discussed.

W. W. SKINNER.

**Spraying Apples for Plum-Curculio.** BY S. A. FORBES. *Illinois Expt. Sta., Bull. 108.*—Results are stated as to the effectiveness of arsenate of lead spraying, which in some cases increased the value of the crop 150 per cent. The analysis of peelings from apples sprayed the preceding day with four times the usual strength of arsenate of lead showed 0.256 grain of arsenic to a pound of the peelings, or approximately 4 pounds of the peelings to a grain of arsenic.

W. W. SKINNER.

**Insects and Insecticides.** BY C. P. GILLETTE. *Colorado Agr. Expt. Sta., Bull. 114.*—This bulletin contains a description of insects injurious to trees and farm crops and remedies for the same. Also statements regarding the chemical composition of various poisons and methods of preparing and using them.

W. W. SKINNER.

**A Test of Different Sprays for San Jose Scale.** BY W. E. RUMSEY AND F. E. BROOKS. *West Virginia Expt. Sta., Bull. 107.*—The writers believe that the concentrated soluble oil preparations are the most convenient to use of any material yet devised for the destruction of scale insects, but that none of them are as efficient as the lime and sulphur sprays. W. W. SKINNER.

**Comparative Experiments with Various Insecticides for the San Jose Scale.** BY S. A. FORBES. *Illinois Expt. Sta., Bull. 107.*—Twenty-seven different kinds and forms of insecticides were experimented with, the results generally establishing the superiority of the lime and sulphur washes. Seventeen preparations with a lime and sulphur basis were used. The writer concludes that the most efficient and cheapest insecticide is the simple lime and sulphur mixture, without salt or blue vitriol, dissolved by boiling together. The cold solution of lime and sulphur made with soda was found less than one-third as effective as the washes dissolved by boiling, and was also more costly.

W. W. SKINNER.

**Notes on the Oxidation of Linseed Oil.** BY A. H. SABIN. *J. Chem. Ind. 25, 578.*—The effect of air on surfaces coated with linseed oil was tried by drawing air through a series of flasks covered on the inside by a film of oil. It was found that the oil did not remain in a film on the glass but collected in drops. Though care was taken to purify the air passing through, no uniformity of oxidation could be noticed. It was, however, observed that while there was bleaching and evidence of drying in the first flask in a day or two, the other flasks were successively slower in showing evidence of drying. Evidently the small quantity of oil in the first flask removed something from the air that prevented its action on the oil in the succeeding flasks. The suggestion is made that this drying may be due to ozone, which would explain why oil dries more rapidly out of doors than within.

PERCY H. WALKER.

**Paints and their Composition.** BY E. F. LADD AND C. D. HOLLEY. *Bull. 70, North Dakota Agr. Expt. Sta. p. 83.*—This bulletin, like Bulletin 67 from the same station, deals mainly with white lead and zinc white paints. The proper proportion of vehicle to paint is about 35 to 40 per cent. fluid and 60 to 65 per cent. solid. Attention is called to the fact that with linseed oil at 40 cents a gallon it is decidedly profitable to the dealer to increase the amount of oil. The author states that when water is present in the fluid portion in amounts not exceeding 1.5 per cent. it should not be considered an adulterant; but many paints contain much more than this amount of water. Twenty-three analyses show water in amounts varying from 9.1 to 24 per cent. Short measure seems to be an almost universal rule. All white

leads and so-called white leads examined were found to be short weight, this shortage generally varying from 11 to 17 per cent. The amount of inert material in a number of paints is excessive, often from 30 to 70 per cent. When one considers that with white lead at from \$6.38 to \$6.50 per cwt., and whiting at 43 to 50 cents per cwt. the fraud of this loading is apparent. Cheap ochres are largely used, nominally as coloring-matter but really as an adulterant. In discussing ochre the authors say, "of one thing, however, we feel confident and that is that the average American ochre, as employed in paint manufacture at the present time and especially for the purpose of priming, cannot be too strongly condemned. It has not the virtue that has been claimed for it. In the judgment of the writer, ochre as now furnished should never be used on a good building as a priming coat. The purest white lead and the best linseed oil, or, in lieu of these, the highest grade of mixed paint well thinned down had far better be employed in priming a house than to use ochre." The amount of volatile oils is often excessive. In a number of paints when the best driers are used from 4 to 7 per cent. volatile oils seems to be about the right amount, but a number show from 15 to 30 per cent., usually a very cheap product, largely benzine and in some instances probably rosin driers. A number of so-called white leads contain not a trace of white lead. The strong case that is made out in this bulletin in regard to short weights, and measures, use of inferior materials, and absolutely false statements about their products by some houses makes it apparent that a system of inspection, such as is being introduced into North Dakota, would be of great benefit to all other states. PERCY H. WALKER.

### Recent Experiments in the Nitrogen-Enrichment of Soils.

By F. T. SHUTT AND A. T. CHARRON. *Transactions Royal Society Canada, Vol. 11, Sec. 3*, 53 pp.—Prairie soil from the Indian Head Farm, which, since 1883, has produced thirteen cereal crops, and has been in fallow nine alternate years, has lost, when compared to adjoining virgin soil, 1422 pounds of nitrogen per acre in the first four inches and 2206 pounds in the first eight inches. The crops have removed only 694 pounds, leaving more than twice this amount—1512 pounds—which must have been lost by the cultural methods used. The analyses of a number of legumes showed that ordinary crops of these contained, in the total crop, 100 to 150 pounds of nitrogen. When mammoth clover was grown two seasons in succession, both in pots and on plots of a soil low in nitrogen, and the crop was incorporated in the soil, the soil, by analysis, contained 179 and 175 pounds, respectively, more nitrogen, than in the beginning. Where clover was grown, the succeeding crops of corn, oats and sugar-beets were considerably larger than where wheat was grown. So, too,



clover, seeded in the oats, affected favorably the yield of succeeding corn and potato crops, as compared with oats alone.

J. H. PETTIT.

**Reclamation of Alkali Soils.** BY CLARENCE W. DORSEY. *Bull. 34, Bur. Soils, U. S. Dept. Agr.*—"Alkali" is made up of chlorides, sulphates and carbonates of sodium, magnesium and calcium. These result from mineral decomposition in the absence of sufficient rainfall. Alkali accumulations may be prevented by liberal surface irrigation and the prevention of surface evaporation. Alkali soils may be handled by using alkali-resistant crops, by using chemical antidotes, as in the treatment of black alkali by gypsum and by removing the alkali. This last can be accomplished, with varying degrees of success, by scraping the surface and flooding with or without artificial drainage. Results of experiments with this method in Utah, Washington and Arizona indicate that adequate drainage, after the water has been applied, is the one great question in reclaiming alkali soils.

J. H. PETTIT.

**Calcium Sulphate in Aqueous Solutions. A Contribution to the Study of Alkali Deposits.** BY F. K. CAMERON AND J. M. BELL. *Bull. 33, Bur. Soils, U. S. Dept. Agr.*—The character of drainage from alkali soils can not be predicted from a knowledge of the relative solubilities of the salts present. Solubility is affected by the presence of other salts. Calcium sulphate exists as a hemihydrate, a dihydrate (gypsum), natural anhydrite, and artificial anhydrite. Of these, gypsum and natural anhydrite are the only two forms which are stable in the presence of any solution. They occur together in nature. The solubility curve for calcium sulphate passes through a maximum at 40° with about 2150 parts per liter. Sulphates and calcium salts giving a common ion all depress this curve, with the exception of sulphuric acid. With 48 parts per liter of the latter, the results are the same as with water. With low concentrations, solutions of electrolytes which do not give a common ion increase the solubility of gypsum. Non-electrolytes differ in their effect upon the solubility of gypsum.

J. H. PETTIT.

**Soil Fertility.** BY MILTON WHITNEY. *Farmers Bulletin, 257, U. S. Dept. Agr.*—A popular presentation of the subject of soil fertility, as commonly understood, is given, but especial attention is drawn to toxic principles given off by plants and to the sanitary conditions of soil—which conditions are now being investigated in particular by the Bureau of Soils. The details of the Bureau's wire-basket method are included.

J. H. PETTIT.

**Water-Resisting Qualities of Modern Sole Leather.** BY J.

G. PARKER. *Shoe and Leather Reporter*, 83, No. 4, 68.—The author has made an examination of differently tanned leathers to show resistance to penetration by water. The leathers were subjected to the pressure of a column of water 12 inches high and 2 inches in diameter, and the time noted when the water penetrated and moistened the leather evenly. The height to which water rose by capillarity in a given time when one end was immersed in water was also noted. Average results were as follows:

	24. Oak bark tanned 10 months.	9. Mixed tannage 10 months bloomed.	Samples. 24. Mixed tannage 5 months scoured.	10. Hemlock tanned unbleached.	12. Hemlock and quebracho bleached.
Water penetrated in .....	156	144½	86½	162	73¼ hrs.
Capillary rise in 12 hrs..	½	⅜	1⅜	¾	2 inches.

To show that the modern practices of scouring, bleaching, sumaching, and treatment in hot liquors dissolve the difficultly soluble matters from the leather, thus making it more porous, four sets of samples were prepared in three different yards. Set No. 1 on removal from last layer was brushed over, oiled, sammed, hand-pinned, rolled and finished. Set No. 2 finished in the ordinary manner and scoured, but after scouring were put through a weak sumach liquor, oiled, dried, stretched and rolled. Set No. 3 were scoured direct from the layers; after scouring was vatted with an ordinary liquor containing a proportion of extract and sumach, and afterward finished as usual. Set No. 4 was scoured, vatted in a bleaching extract and finished. All hides and processes were as nearly identical as possible. The results were:

	Average set number.			
	1.	2.	3.	4.
Water penetrated in .....	133½	106¼	94½	62 hours.
Capillary rise in 12 hours .....	⅜	¾	1½	2 inches.

A protest is made against these unnatural treatments of leather simply for the sake of obtaining a pleasing appearance.

F. P. VEITCH.

**Chroming of Hide Powder.** By C. W. NORRIS. *J. Am. Leathers Chem. Assn.* 1, 203.—This is the report of the chairman of the sub-committee appointed by the referee of the Leather Chemists Association on different methods of chroming hide powder for the determination of tannin. In addition to the regular method of chroming them, other chrome liquors, to which different quantities of sodium carbonate were added, and a powder chromed according to Kopecky (*Collegian* No. 199), were used in the experiments, being added in the powder at the rate of 5, 10 and 20 per cent. of chrome alum in solution. The average non-tannins, using the differently chromed powders, were as follows:

		Quebracho extract. Per cent.	Hemlock extract. Per cent.	Chestnut oak extract. Per cent.
Official powder.....		15.03	23.65	19.59
Kopecky (Teas) powder .....		14.39	22.93	19.88
5 per cent. {	Chrome powder No. 1....	15.42	23.57	19.43
	“ “ “ 2....	15.45	23.49	19.37
	“ “ “ 3....	15.34	23.62	19.29
10 per cent. {	“ “ “ 1....	14.50	23.22	19.25
	“ “ “ 2....	14.61	22.82	19.23
	“ “ “ 3....	14.74	23.31	19.02
20 per cent. {	“ “ “ 1....	14.90	23.39	19.58
	“ “ “ 2....	14.87	22.87	19.44
	“ “ “ 3....	14.99	23.41	19.44

Where the powder was heated with 20 per cent. of chrome alum it was completely chromed. The author believes that absorption decreases with heavier chroming and increases with the basicity of the chroming. Such chromed powders have no particular advantage if they cannot be dried after chroming.

F. P. VEITCH.

**Plant Growth as Influenced by Soil Acidity.** By F. P. VEITCH. *Proceedings 22nd Annual Convention, A. O. A. C., 1906*, 118.—Red clover, alfalfa and cowpeas were grown on a soil the acidity of which was partly neutralized on some plots and fully neutralized on others. Alfalfa was practically a failure on all plots, small yields being obtained only from the partly and the fully neutralized plots. Clover and cowpeas gave the greatest yield on the fully neutralized plots. Cowpeas produced the largest crop when twice as much lime was added as was needed to neutralize acidity. In a study of the reaction of soils from the rotation plots of the Ohio station it is shown that sodium nitrate and basic slag materially reduce acidity, while ammonium sulphate increases it. Acid phosphate, potassium chloride and barnyard manure were practically without effect on the reaction. Completely neutralized plots have produced the highest yields of corn and hay.

F. P. VEITCH.

**On the Proper Strength of Acid to be Used for Determining Available Plant Food in Soils.** By A. M. PETERS AND S. D. AVERITT. *Proceedings 22nd Annual Convention A. O. A. C., 1906*, 115.—The authors are of the opinion that “the agricultural significance of amounts of phosphorus ranging from 2 to 8 parts per million of soil is almost infinitesimal and that such weak solvents as distilled water and N/200 acid are entirely inadequate for determining available plant food.” Figures are given showing the quantity of phosphorus and potassium dissolved from several soils of different strengths of nitric acid. N/5 nitric acid is thought to bring out best differences in availability.

F. P. VEITCH.



**A Modified Method for the Determination of Total Phosphorus in Soils.** BY J. H. PETTIT AND YSTGARD. *Proceedings 22nd Annual Convention A. O. A. C., 1906, 111.*—The soil is fused with sodium peroxide in the usual way and the fusion dissolved in hydrochloric acid. Silica is separated from an aliquot portion of the solution, the solution precipitated with ammonia, filtered, and the precipitate dissolved in hydrochloric acid. After again separating silica the determination of phosphorus is completed by the molybdate-volumetric method in the usual manner.

F. P. VEITCH.

**Notes on the Determination of Albuminoid Nitrogen in Cereals.** BY J. A. LECLERC AND W. C. LOWNSBURY. *Proceedings 22nd Annual Convention A. O. A. C., 1906, 150.*—It was found that the addition of alum solution after the copper hydroxide in Stutzer's method dissolves albuminoids from gluten and from oats, thus giving apparently higher results for amino bodies. The more alum solution used the lower the albuminoid nitrogen. If alumina cream or a large amount of copper hydroxide be used, the results are close to those obtained with copper hydroxide alone.

F. P. VEITCH.

**Effects of an Unbalanced Ration.** BY W. M. MUNSON. *Science, 23, 752.*—In August, 1904, the fruit of certain trees in an orchard when about the size of walnuts began to crack and drop. No evidence of insects could be discovered nor of fungus disease. Nearly all fruit dropped and what remained on the trees dropped easily and was small, soft, spongy, and the surface much pimpled. Such fruit was confined to trees where large amounts of sodium nitrate alone or in combination had been used. The supposition is therefore made that the trouble is physiological and due to the excessive amount of available nitrogen and a lack of potash.

F. P. VEITCH.

**Comparative Value of Steamed Bone Meal and Finely Ground Natural Rock Phosphate.** BY C. G. HOPKINS. *Proceedings 22nd Annual Convention A. O. A. C., 1906, 110.*—In pot experiments using a "distinctly acid" soil from the gray silt loam of Illinois, it was found that in combination with green manuring, manure and potash salts, finely ground rock gave a slightly higher average of wheat than the steamed bone meal.

F. P. VEITCH.

**Report of the Referee on Potash.** BY G. S. FRAPS. *Proceedings 22nd Annual Convention A. O. A. C., 1906, 134.*—Potash was determined in mixed fertilizers by the official method, by a modification of this method in which the fertilizer is digested in very dilute hydrochloric acid neutralizing the acid with caustic soda solution, and by the phosphomolybdic acid method. The

results by the modified method agreed more nearly with theory than those of the official method. The results by the phosphomolybdate method agreed quite well with those by the official method in the hands of the collaborating analysts. The referee determined that the solubility of the potash of feldspar, microcline, leucite and apophyllite by the modified method was small. Muscovite yielded 1.33 per cent. of potash to the modified method and 0.91 per cent. to the official method. F. P. VEITCH.

**Modification of the Method of Determination of Phosphoric Acid.** BY A. B. FOSTER. *Proceedings 22nd Annual Convention A. O. A. C.*—Two grams of fertilizer are treated with 10 cc. hot water and allowed to stand one-half hour or longer when 90 cc. of neutral ammonium citrate (sp. gr. 1.1) previously heated to 85 cc. are added and the whole digested one-half hour at 65°. The solution is filtered and made up to volume and available phosphoric acid determined in the filtrate by the citrate method. The results average somewhat higher than by the official method. F. P. VEITCH.

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## PATENTS.

FEBRUARY 6, 1906.

811,827. Max Conrad, Aschaffenburg, and Walter Becke, Darmstadt, Germany. **Pyrimidine derivatives.** 4-Imino-2-6-dioxypyrimidine is made by condensing acetylurea with cyanacetic acid ester in the presence of alkali.

811,828. As above, for pyrimidine derivatives. 3-Methyl-4-imino-2-6-dioxypyrimidine is obtained by condensing methylurea with cyanacetic acid ethyl ester in the presence of alkali.

811,829. As above, for pyrimidine derivatives. 3-Methyl-4-imino-2-6-dioxypyrimidine is made by condensing acetylmethyl urea with cyanacetic acid ethyl ester.

811,884. Frederic W. S. Valentiner, Leipsic, Germany. **Salicylic acid *m*-methylene acetate.** The compound  $C_{10}H_{10}O_6$ , obtained from the reaction of formaldehyde on acetylsalicylic acid, melting at 108° and soluble in water.

811,902. Carle D. Clark, Clifton, Ariz. **Hydraulic cement.** The tailings from ores with an aluminous siliceous gangue, are mixed with a calcareous substance, clinkered and ground.

811,941. Charles E. Matthews, Rio, Wis. **Chlorate powder.** One part sugar is mixed with  $1\frac{1}{2}$  parts potassium chlorate, and moistened with a mixture of gasoline, spirits of turpentine and alcohol, one part each and two parts water.

811,954. John F. Richardson, Pittsburg, Pa. **Brazing steel and copper.** The steel is brought to a white heat, covered with

flux, a sheet of brass laid on and more flux and then the copper and the whole compressed.

811,971. Salomen Szekeley and Emerich Kovacs, Buda Pesth, Austria-Hungary. **Imitation human milk**, germ-free, is made from cows milk by heating it just below the coagulating point of albumin, introducing carbon dioxide at not less than four atmospheres pressure, stirring to precipitate suspended matters, separating the whey from the precipitate and sterilizing the latter, and mixing the whey and precipitate in the desired proportions.

811,989. Charles E. Wirth, Waterbury, Conn. Assignor to Plume & Atwood Manufacturing Co. **Bunsen burner**. The gas nipple has a revolving cap, controlling the supply of gas, the lower portion of the burner tube being enlarged in cone shape to fit over the nipple.

812,028. Arthur Eichengrun, Elberfeld, Germany. Assignor to Elberfeld Co., New York, N. Y. **Flash light composition**. Magnesium and tungstates in varying proportions.

812,098. Robert W. Strehlenert, Djursholm, Sweden, Friedrich Reubold, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. **Cellulose acetate**. Cellulose is treated with caustic soda, then with acetic anhydride 400, sulphuric acid 1.5 and benzene 1500 parts.

812,108. George C. Wyatt, Rome, Ga. **Plaster compound**. Lime 100, sawdust 100, clay and sand 200 each, plaster of Paris 300, and cement 100 parts by weight.

812,124. Emile A. Fourneaux, New York, N. Y. Assignor to Hermann A. Metz, same place. **Formaldehyde hydrosulphite**. also known as hyraldite. An alkali as sodium carbonate is added to a solution of zinc hydrosulphite in formaldehyde that will not reduce indigosulphonic acid at ordinary temperature, making alkali formaldehyde hydrosulphite (S), which is a white crystalline precipitate, that can be dried on the water-bath without decomposition, and capable of reducing one and one-half times its weight of indigo in the form of indigosulphonic acid.

812,174. Gustav Grondal, Djursholm, Sweden. Making **iron sponge**. A mixture of iron ore and carbon is fed into a shaft furnace with staggered flues through which gas and air pass up, reducing the iron to iron sponge.

FEBRUARY 13, 1906.

812,178. Shipley N. Brayshaw, Hulme, Manchester, England. Assignor to George Nash, New York, N. Y. **Bath for hardening steel**. The bath consists of a compound of several salts soluble in water, any one of which separately melts at a higher temperature than the compound, and a carburizing agent. A fusible



compound of sodium chloride and potassium chloride may be used.

812,193. Byron E. Eldred, Bronxville, N. Y. Assignor to Combustion Utilities Co., New York, N. Y. **Blast combustion.** Pulverized fuel is projected into a reverberatory furnace in suspension in a forcible current composed entirely of air and products of combustion, such products being in sufficient amount to retard combustion but completing said combustion by radiant heat from the roof of the furnace.

812,195. Richard Escales, Munich-Schwabing, Germany. **Explosive compound.** Consists of an oxygen carrier, as ammonium nitrate and an easily oxidizable metal as aluminum in the shape of aluminum wool.

812,247. Gustaf M. Westman, New York, N. Y. **Reducing iron ore.** A stream of water is sprayed into a current of air and the temperature of the mixture is raised and subjected to the action of incandescent coke mixed with limestone to produce carbon monoxide and hydrogen free from sulphur. The proportion of the air to steam is so regulated that the temperature of the mixture of resulting gases is maintained at about 1100°. At this temperature the gases are passed through the ores to be reduced.

812,357. John P. Neville, Oakland, Cal. **Preparing lead compounds.** A dry method of preparing white lead, litharge and red lead by first reducing the material to be used to a powder and withdrawing such powder by air-suction into a separator where the heavier particles of lead settle by gravity from the laden air, which latter is treated with a gas as ozone to oxidize and eliminate all foreign substances such as tanbark, etc., the water grinding of the lead pulp being dispensed with.

812,399. James F. Bottomley, Wallsend, Robert S. Hutton, Manchester, and Arthur Paget, North Gray, England. **Manufacture of silica glass from pure quartz.** The crude materials are fused by the heat generated by a resistance such as carbon in an electric circuit but which is not in contact with the materials, the heat being applied till the mass is in a plastic condition. While still plastic the mass is shaped by internal blowing.

812,441. William E. Nickerson, Cambridge, Mass. Assignor to Gillette Safety Razor Co., Boston, Mass. **Method of hardening.** Thin steel articles are interleaved with sheets of metal of relatively high heat conductivity as compared with the steel, the articles and sheets being confined in a stack, the sheets projecting beyond the edges of the articles; the stack is heated and while hot is subjected to the action of a flow of cold liquid.

812,473. Ernest W. Arnold, San Francisco, Cal. Assignor one-

half to Vistor Selna, same place. **Treating ores.** Refractory ores heated to incandescence are treated with a blast of a suitable hydrocarbon and then impregnated with a mixture of chlorine gas and charcoal fumes, there being about two parts of chlorine to one part of charcoal fumes.

812,493. William Hoskins, Lagrange, Ill. **Granulating aluminum.** Aluminum and other metals whose oxides have a high melting-point are reduced to a more or less finely divided condition by forcing an oxidizing gas into the molten mass, at the same time mechanically stirring, and continuing the stirring while the mass is cooling.

812,494. Alfred R. Hussey, Chicago, Ill. **Soldering compound.** Consists of soft metals rendered finely granular, and mixed with a flux-impregnated fatty substance and made into sticks or bars, in combination with a retaining skin adapted to be fused with the substance of the sticks, as tinfoil. The fatty substance prevents oxidation of the metal.

812,553. Alfred E. Dubey, New York, N. Y. **Tympan-offset paper.** Consists of two plies felted together in manufacture, one being a strong and relatively non-absorbent paper, the other being a relatively soft absorbent paper treated with mineral oil.

812,554. Alfred Einhorn, Munich, Germany. Assignor to Farbwerke vorm. Meister, Lucius & Brüning, Höchst-on-Main, Germany. **Alkaline esters of *p*-aminobenzoic acid.** A colorless compound very little soluble in water, but very readily soluble in alcohol, ether and benzene; solidifies in the cold; alkaline reaction with litmus; decomposes when heated with hydrochloric acid or soda-lye into *p*-aminobenzoic acid diethylaminoethanol; forms a salt with one equivalent of hydrochloric acid which crystallizes from absolute alcohol in needles which melt at 156°; the solution is anesthetic without irritation.

812,582. Gustavus Michaelis, Albany, N. Y. **Paint remover.** Consists of a hydrocarbon and an alcohol of at least 97° strength; and a water- and alcohol-soluble soap, dissolved therein with the aid of heat, and in suitable proportions.

812,593. Louis Preaubert and Gaston A. Thube, Nantes, France. **Tarring roads.** The product consists of a mixture of a solution of casein in water in the presence of an alkali 25, a bituminous body as asphalt liquefied by heat 70, and water an equal weight. When used two or three volumes of water are added.

812,598. Albrecht Schmidt and Erich Kronholz, Höchst-on-Main, Germany. Assignors to vorm. Meister, Lucius & Brüning, same place. **Chlorinating indigo.** An indigo body is treated with sulphuryl chloride.

812,599. Robert E. Schmidt and Karl Thun, Elberfeld, Germany. Assignors to Farbenfabriken of Elberfeld Co., New York, N. Y. **Yellow-green anthraquinone dye.** By treating 1-4-8-trihydroxyanthraquinone with sulphonating agents and boric acid 1-4-8-trihydroxyanthraquinonesulphonic acid is obtained which by condensation with *p*-toluidine yields 1-4-di-*p*-tolylldiamino-8-hydroxyanthraquinonesulphonic acid containing the sulphonic group in the anthraquinone nucleus, which dyestuff in the shape of its sodium salt is a dark green powder soluble in concentrated sulphuric acid with a violet-blue color, and when a solution of the dyestuff in acetic acid is treated with a solution of stannous chloride in hydrochloric acid it is decomposed with the formation of a leuco compound of the 1-4-8-trihydroxyanthraquinonesulphonic acid; dyes unmordanted and chrome mordanted wool yellowish green shades.

812,608. Alfred Stephan, Gross-Lichterfelde, near Berlin, Germany. **Making a formic aldehyde compound.** Phenol 200, and formic aldehyde solution of 40 per cent. 400 are heated with an addition of potash lye 100 parts as a condensing medium and dissolvent until a red-brown liquid is produced out of which acids precipitate a deposit. The former is a disinfectant, the latter an antiseptic.

812,631. Tomas Bargiela, Jose P. Mislowsky, Alfredo Caricchia, and Louis E. Oido, Buenos Ayres, Argentina. **Ether mixture for disinfecting.** Consists of the distilled product of a mixture of eucalyptus leaves 30, and camphor 5, in ethyl, methyl and amyl alcohols 300 each, hydrochloric acid 100, sea-salt 380, sulphuric acid 35, acetate of ammonia 60 parts the whole being distilled and the distillate saturated with  $\text{NO}_2$ .

812,639. Charles H. Cheesman, Burlington, N. J. **Making stiffening material.** Water is heated to the boiling-point, dextrin then added, and then allowed to cook till the dextrin is dissolved; ground glue is then added and the mixture heated till it comes to a boil, alum being then added and the whole allowed to cool. Afterward it is heated till it is in condition to flow and water is added to thin the mixture.

812,684. Robert E. Schmidt, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N. Y. **Green anthraquinone dye.** A new dyestuff obtainable by sulphonating 1-4-diaryldiamino-8-hydroxyanthraquinonesulphonic acids containing the one sulphonic group probably in the anthraquinone nucleus and the other in the aryl nucleus, which dyestuffs are in the shape of their alkaline salts, green powders easily soluble in water with a green color; being dissolved by concentrated sulphuric acid of 66° Baumé with a bluish green color and on heating in a solution of stannous chloride in hydrochloric acid



it is decomposed under the formation of the 1-4-8-trihydroxy-anthraquinone sulphonic acid; dyes wool yellowish green shades.

812,764. John E. Mitchell, St. Louis, Mo. **Treating flour.** Air is subjected to the action of the flaming electric discharge whereby it is modified, oxides of nitrogen being formed. This modified air is stored for an appreciable time and then the flour to be treated is subjected to its action.

812,777. Ernest E. Werner, Indianapolis, Ind. **Treating flour.** Air is forced through aqua ammonia and the vapor mixed with air; the mixture is passed over a hot metallic oxide and the flour or other cereal is subjected to the action of the resultant gas.

812,785. Arthur M. Day, Butte, Mont. **Smelting and converting ores.** Crude ore which contains or is mixed with a combustible substance as sulphur is covered over with a molten substance containing sufficient heat to start fusion of the charge; air under pressure is supplied to the top of the charge under the molten covering as fusion progresses downward; fuel flux and silicious material in a fluent form are injected with air blasts delivered at or near the melting level.

FEBRUARY 20, 1906.

812,810-11. Walter Brinton, High Bridge, N. J. Making rails of **manganesee steel** and tempering them by heating to a given temperature and chilling them in cold water. The rail may be chilled and reheated.

812,837. Harry Feder, New York, N. Y. **Waterproofing twine.** The material is treated with casein and then with formaldehyde.

812,959. Fin Sparre, Wilmington, Del. Assignor to Du Pont de Nemours Powder Co., same place. **Explosive.** Ammonium nitrate 60, ferrosilicon 15, nitroglycerol 20 and kerosene less than 10 per cent.

812,978. James W. Chase, Buffalo, N. Y. **Wall plaster.** Calcined gypsum, Portland cement, acetic acid, and palmetto root fiber.

813,088. Geo. G. Gilmor, New Orleans, La. Assignor to American Turpentine and Car Co. **Refining turpentine.** The turpentine is settled from the pyroligneous acid, half its volume of water added and the whole distilled, the water settled off and lime-water added to the turpentine, the whole blown up and the lime-water run off, the turpentine then distilled off.

813,105. Wm. F. M. McCarty, Rocky Ridge, Md. Assignor to Thomas A. Darby Trustee, New York, N. Y. **Decomposing water.** Metallic sodium is added to the water and an electric current passed through it.

813,147. Stanley K. Green, Baltimore, Md. **Treating oxidized tin.** Oxidized tin sheets are subjected to molten lead in the presence of a suitable flux or grease.

813,155. Georg Kalischer, Frankfort-on-Main, Germany. Assignor to Cassella Color Co., N. Y. **Red azo dye.** An aromatic diazo compound is added to the 5-hydroxynaphtho diaminobenzaldehyde-7-sulphonic acid, forming a red powder of a metallic luster, water-soluble yellow to blue-red, soluble in concentrated sulphuric acid blue-red.

813,199. Niels H. Claussen, Copenhagen, Denmark. **Malt liquor.** Cultures of *Brettanomyces* are added to Pasteurized beers to produce, by this specific fungus, the flavor of English beer.

813,218. Carl Kochmann and Julius Kaufmann, Berlin, Germany. **Waterproofing.** First saturate the goods with alum and then with carnauba wax.

813,256. Shin-Ichi-Takaki, New York, N. Y. **Pipette.** A bulb pipette of the usual form has a rubber compression bulb on the upper end of the stem and a valve immediately below it.

813,272. Julius Altschul, Berlin, Germany. Assignor to Aktien Gesellschaft für Anilin Fabrikation, Berlin, Germany. **Silk fibroin peptone.** Silk fibroin is added to an excess of 80 per cent. sulphuric acid between 0° and 25° till only a slight precipitate is made by alcohol, then calcium carbonate is added to neutralize, filtering and evaporating to dryness, and repeating this operation with acetone as a solvent.

813,373. Frederick W. Gaertner, Niagara Falls, N. Y. **Extracting albumin.** Peroxide of sodium up to 1 per cent. is added to water slowly, which contains a slight excess of sulphuric acid, the albuminous material is suspended in a bag of filter cloth in the solution, the precipitate removed, rinsed, dried and ground.

FEBRUARY 27, 1906.

813,532. Carl Suter and Berthold Redlich, Ratibor, Germany. **Electrolytic production of alkaline earth metals.** The salt to be treated is melted and submitted to electrolysis, the cathode being caused to move slowly with reference to the electrolyte during electrolysis.

813,605. Joseph G. Weyer, Providence, R. I. **Forming molds for casting.** Equal quantities of plaster of Paris and finely-sifted coal ashes which have each been previously mixed with water are then mixed together, and poured around a pattern to form portions of a mold, which portions are allowed to set and dry without heat. When the mold is complete the pattern is removed and the mold subjected to a moderate uniform heat for a period not exceeding five hours, after which it is allowed to cool.

813,620. Joseph A. Comer, Los Angeles, Cal. **Extracting**

**gold, silver, etc.** The ores of gold, silver or other metals are subjected to the action of an alkaline solution of potassium cyanide; the pulp and other foreign materials suspended therein are then eliminated and compressed air is forced into the solution and the sedimentary matters suspended in it. The metals are deposited by means of electricity.

813,627. Byron E. Eldred, Brookline, Mass. Assignor to Combustion Utilities Co., New York, N. Y. **Cement-burning process.** A stream of cement-forming material is fed along the hearth of a reverberatory chamber and over it in the opposite direction is passed a long slow-burning flame given off from an external fuel bed through which is passed, under forced draft, air and a portion of diluent stack-gases, and a portion of the flame is intensified locally near the exit of the material by means of a transverse jet of air intercepting the flame or gas current and directed upon the material. The apparatus consists of a reverberatory chamber having means for advancing the material, an external fire-box opening into this chamber and having means for burning a bed of fuel, means for supplying air and a neutral gas to the draft chamber of the fire-box, and means for producing a local high temperature near the end of travel of the material.

813,643. Richard Gley, Berlin, Germany. Assignor to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany. **Orange-yellow sulphur dye.** A mixture of diformyl-*m*-toluylenediamine and *p*-phenylenediamine is heated to above 200° with sulphur, forming a product which when pulverized is a brown-red powder, insoluble in water and alcohol, soluble in soda-lye with a yellow color, which solution by the addition of hydrochloric acid separates yellow-brown flakes, soluble in sodium sulphide with a yellow color, dyeing from a bath containing sodium sulphide and common salt clear orange-yellow shades of great fastness to washing and milling.

813,647. August F. J. S. Haake and Heinrich A. R. A. Haake, Hamburg, Germany. **Preparing soluble starch.** Common starch 100 and hypochlorite of lime 7 are mixed with sodium bicarbonate 1 part, all to be mixed in the dry state, the dryness of the starch being that commonly referred to when the starch contains approximately about 20 per cent. of water. The mixture is at once ready for use.

813,709. Joseph James, Baltimore, Md. **Composition for cleaning.** Consists of a solution of an acid as acetic acid 13 parts, solution of strontium nitrate (saturated) 7.5 parts, nitric acid 5 parts and water 15 parts. The composition is applied to the cleaning of lithographic stones after use.

813,728. Clarence T. Marsh, Cincinnati, Ohio. Assignor of one-half to Louis H. Weissleder, same place. **Testing coloring-matters in distilled liquors.** Amyl alcohol which has been



rendered colorless by distilling fusel oil with a caustic alkali is mixed with water; this mixture is then added to the whisky which is to be tested and the whole allowed to rest. The amyl alcohol and the alcohol of the whisky become associated while the water, by greater specific gravity, separates carrying with it and being colored by any artificial coloring-matters previously present in the whisky.

813,786. Laurent Fink-Huguenot, Paris, France. **Producing metallic oxides.** A fused metal is caused to flow in a current under a strong pressure, and mingled with an elastic fluid, a portion of the force of the elastic fluid being utilized to create the strong pressure; the current is confined to a restricted space to form a vortex jet, and finally an oxidizing flame is directed against the jet.

813,824. Enos C. Pollard, Seattle, Wash. **Smelting and refining.** Metal ores as copper, containing sulphur are melted in the presence of a flux to form a matte, the matte is separated from the slag and the ore, and a stream of slag is passed over the matte; the matte is bessemerized in the presence of the slag, the lighter portion of the latter being drawn off, and a part being returned to the ore-smelting regions at a higher plane than the bessemerizing regions, and the slag from the smelting regions is returned with the new matte to the bessemerizing regions.

813,841. Maximillian Toch, New York, N. Y. Assignor of one-half to Henry M. Toch, same place. **Treating cement.** To Portland cement constructions are applied on the surface, a solution containing an acid resin as copal, a vegetable drying oil and a diluent as turpentine, and then applying a mixture containing a dissolved resin and a pigment in drying oil.

813,878. Ernest W. Friedrich, Blaton, Belgium. **Cellulose solution.** Cellulose is moistened with hot water, pressed and treated with a solution of caustic soda, copper sulphate added, after which it is filtered and the residue triturated, a solution of monomethylamine is added.

813,911. David J. Ogilvy, Cincinnati, Ohio. **Producing Carbonaceous pigments.** Black or dark-colored pigments are produced by causing a carbonaceous flame in motion to be impinged upon water in motion, the water containing suitable soluble material to overcome or diminish the repellant properties of the carbonaceous deposit toward the water.

813,965. Bernhard Grau, Kratzwieck, near Stettin, Germany. **Production of cement.** A sufficiently strong and violent jet of superheated steam is blown against a jet of molten blast-furnace slag, and the slag, so divided, is driven off by the steam jets so as to form a heap of slag, and the mass allowed to cool itself without artificial means, the mass being afterward ground.

MARCH 6, 1906.

814,007. Max Ams, Mt. Vernon, N. Y. **Molding compound for casting metal.** Powdered mineral wool 2, plaster of Paris 3, and agar-agar 1 and 2 parts water.

814,031-2. Emile A. Fourneaux, New York, N. Y. **Zinc formaldehyde hydrosulphite.** Zinc is caused to react on an alkali formaldehyde bisulphite, supplying acid at such rate that the presence of free acid is avoided, and basic zinc formaldehyde hydrosulphite (S) produced. The second is for the same compound, made by acting with zinc on sulphurous acid and formaldehyde in solution, two molecules to one, then adding two molecules of formaldehyde, and reducing the resulting solution with one molecule of zinc.

814,036. Leon Gerard, Brussels, Belgium, Assignor to Percy Thompson, East Orange, N. J. Testing for **decoloration of water.** A flow of water is led through a vessel which provides a constant depth of water, the bottom being transparent, and a constant source of light above and a moving photographic film below said vessel.

814,049. Woolsey M. Johnson, Hartford, Conn. **Treating matte.** Roasted nickel and copper sulphide matte are dissolved in sulphuric acid and electrolyzed to separate a part of the copper, a residue of copper sulphide is subjected a second time to roasting, etc., and again electrolyzed, till the nickel interferes with copper deposition, and the residues are then mixed with fresh quantities of the matte, and again treated.

814,108. John Bachmann, Jersey City, N. J. **Color prints,** from type printing press. Negatives of the copy are made with color filters, preparing a chrome gelatine plate by first coating it with a clear solution of porter, containing some caustic soda and sodium silicate, drying it, washing with hot water and applying the chrome gelatine, printing the negative on it, developing with printing inks, having several negatives of various shades of each positive, and preparing the type color plates from these negatives.

814,137. Max H. Isler, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Dianthraquinonylamine.** 1-Aminoanthraquinone is heated with 2-chloranthraquinone in the presence of copper chloride and sodium acetate. A crystalline compound with metallic luster, soluble in most solvents, aniline, nitrobenzene, and concentrated sulphuric acid, the latter greenish blue, and on sulphonation a dye is made coloring wool from acid bath brown-red.

814,155. Wm. F. H. McCarty, Rocky Ridge, Md. Assignor to Thomas A. Darby, Trustee, New York, N. Y. **Apparatus for electrolysis of water.** A tank is divided by a partition in

two chambers, said partition having holes near the bottom filled with short tubes near the ends of which the electrodes end, and tubes in the upper part of the chambers for the collection and delivery of the gases.

814,180. John F. Wixford, St. Louis, Mo. **Water purification.** A system comprising delivery wells connected with a water supply of conduits emptying into the wells above their normal water level, a supply of calcium hydroxide into one conduit and of a coagulant like ferrous sulphate into another, and a settling basin connected with the delivery wells.

814,215. Benjamin Jumeaux and Wm. N. L. Davidson, Brighton, England. **Trichromatic photography.** Negatives are taken through red, green and blue screens and images printed on chrome gelatin films which are then saturated with dyes of complementary colors of the screens used, so that the parts acted on by light will be the last to take up and the last to part with the dyes when the films are soaked in water to obtain direct positives which are then superposed to produce the finished picture.

814,294. John A. Just, Pulaski, N. Y. Assignor to the Just Mining and Extraction Co., Syracuse, N. Y. Recovering **precious metals.** The ground ore is acted on by sulphuric acid to dissolve the baser metals, a current of air passed through the mixture, which is heated, and niter added to it; the mixture is first concentrated and then diluted with acidulated water to about its original volume, the solution drawn off and the residue washed while the metals are precipitated from the solution which is recovered for reuse.

814,334. John C. Taliaferro, Baltimore, Md. Assignor to Continental Can Co., New York, N. Y. Recovering **tin and lead.** Tin scrap is fused in a lead bath on which the iron floats as it is detained.

814,407. Karl von Stechow, Wiesbaden, Germany. **Extracting rubber.** The crushed comminuted plants are first worked in water and then extracted by a hot mixture of acetone and ethyl, methyl and amyl alcohols till all resin, oil and wax are separated and pure rubber obtained.

814,452. Thomas B. Joseph, San Francisco, Cal. **Ore leaching.** The ground ores of gold and silver are put in a solution of sodium cyanide 32, calcium hydroxide 16, barium peroxide 4, and ammonium bicarbonate 4, and then compressed air is forced into the mixture to agitate and oxidize it.

814,490. Ludwig Weiss, Buda-Pesth, Austria-Hungary. **Binding agent.** Sulphuric acid is added to a mixture of calcium and magnesium carbonates, the product dried and a part burned, the burned and unburned portions mixed whereby a cement is made, hardening on the addition of water.



814,496. Otto Wolfes, Darmstadt, Germany. Assignor to E. Merck, same place. **Barbituric acids.** Diethylmalonitrile is condensed with guanidine by the aid of sodium alcoholate, the mixture being then saponified.

814,594. Henry V. Dunham, Bellows Falls, Vt. **Preserving casein.** Assignor to Casein Co., N. J. The casein is precipitated by a mineral acid to which boric acid has been added in the proportion of 0.5 to 1 per cent. as a preservative.

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814,675. Antonio V. de la Corte, San Luis Potosi, Mexico. **Extracting rubber.** The wood containing rubber is subjected to successive finer dry grinding, and at the last grinding with pressure and heat the rubber separates from the wood, gathering into masses.

814,692. Willis E. Harmon, Mechanics Falls, Me. Assignor to American Electrolytic Co., Philadelphia, Pa. A small quantity of powdered carbon is added to the electrolyte in the amalgamating compartment, and the quantity of carbon therein is maintained constant as the process proceeds.

814,693. Arnold H. C. Heitmann and Erik C. Clemmensen, Detroit, Mich. **Alkyl hydroxyacetyl cyanamide.** Assigned to Parke, Davis & Co., same place. Diethylhydroxyacetic ester is condensed with cyanamide and an alkali alcoholate to form a colorless crystalline body, melting at  $235^{\circ}$ , soluble in water and alcohol, but insoluble in ether and most other organic solvents. On hydrolyzing by dilute sulphuric acid it is transposed into a ureide of diethylhydroxyacetic acid.

814,695-6. Peter C. Hewitt, New York, N. Y. **Electric lamp.** Assigned to Cooper Hewitt Electric Co., same place. The Geissler tube contains a liquid at one end adapted to develop a gas, and at the other end a different gas, one of the electrodes being mercury, with means for condensing the mercury vapor.

814,750. Leonard S. Van Westrum, Berlin, Germany. Compound for rendering **packings insoluble.** Castor oil 5, graphite 4, and lime 2 parts are mixed in the bearing or journal to render it insoluble in hydrocarbons.

814,775. George B. Dodge, Boston, Mass. **Embalming compound.** Boric acid 140, zinc sulphate 30, glycerol 16, creosote 1, formalin 300, eucalyptus 16 parts by weight, with perfume and coloring material.

814,810. Frederick T. Snyder, Oak Park, Ill. Treating **zinc ore.** Zinc sulphide is heated with carbon in an electric furnace till the zinc volatilizes, air being excluded and the ore in contact with molten slag, the heat of the furnace volatilizing the zinc and forming carbon bisulphide by the union of the sulphur and the carbon.

814,814. Herbert A. Thomas, Chicago, Ill. Assignor to Dry Amalgamation Co., same place. **Amalgamating process.** A body of mercury is insulated and charged statically, and a thin sheet of pulverized ore is fed through it, whereby the precious metals are amalgamated or removed from the ore and the mercury separated from the tailings.

814,836. Alexander Elliott, Littlerock, Cal. **Separating copper.** Copper is separated from ores containing basic gangue, by leaching the ore with a hot non-acid solution of ferrous sulphate through which air is blown, precipitating the copper by means of iron, and reusing the ferrous sulphate formed to repeat the process. The apparatus consists of a series of tanks arranged stepwise, with a pump to transfer the contents of the last and lowest tank back to the first and highest.

814,847. Edwin J. Hubley, Lancaster, Pa. Assignor to John L. McLaughlin, same place. **Wood filler.** Graphite 4, red lead 3, soapstone  $1\frac{1}{2}$  parts and turpentine enough to make a paste.

814,917. Arthur Pauling and Harry Pauling, Bismarck, Germany. Assignor to Chemische Fabrik, Gladbeck, Germany. **Making nitric acid from air.** A mixture of nitrogen and oxygen as air, is intensely heated and suddenly cooled whereby reversal of the first reaction is prevented, water being also supplied to the nitrous products as steam vapor to absorb them.

815,016. Paul L. T. Hérault, La Praz, France. Assignor to Société Electrométallurgique Française, Froges, Isere, France. **Smelting iron.** The amount of carbon necessary is introduced at the base of the charge while protecting it from the action of the carbon dioxide generated, the necessary heat being supplied by an electric current, and oxygen being introduced at a higher point to oxidize the carbon monoxide formed and at the base to increase the total heat effect.

815,080. Bernard Enright, Fordwick, Va. **Burning cement.** The products of combustion and decomposition from a rotary cement kiln are caused to pass through a vertical cement kiln charged with raw material and a relatively small amount of incandescent fuel to convert the carbon dioxide produced to carbon monoxide, then passing the resultant gases through incandescent fuel to complete the reduction of the carbon dioxide.

815,193. Carl Mettler, Munich, Germany. Assignor to Badische Anilin und Soda Fabrik, Ludswigshafen-on-Rhine, Germany. **Aromatic alcohols.** Aromatic carboxylic acids are electrolytically reduced, using a cathode of high tension as lead, *p*-hydroxybenzyl alcohol from *p*-hydroxybenzoic acid being the example chosen.

815,207. Theodore F. Odell, Nyack, N. Y. **Fire-proof**

**sizing.** Glycerol 1, glue and flour  $1\frac{1}{2}$  each, and alum 4 parts with water sufficient to dilute it.

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815,404. Joseph C. Card, Chicago, Ill. **Preserving wood.** Wood and similar materials are treated by submersion in preservative liquids in a closed receptacle; the fluids are subjected to pressure which is maintained until the wood is impregnated, the fluids being meanwhile caused to circulate. Zinc chloride solution and creosote may be used and pumped through the apparatus.

815,417. Harleston C. Gesner, New York, N. Y., executrix of George W. Gesner, deceased. **Filter.** A rigid porous plate or tube of an alloy of iron and hydrogen. For process of making said alloy, see 642,320 and 670,775.

815,418. Same. **Insulator for electrical apparatus.** 815,419. Same. **Process of making.** Consists of particles of an alloy of iron and hydrogen fritted into a coherent mass, such mass being produced by compressing the alloy into a body and heating the body to a temperature sufficient to cause the particles to frit or partially fuse together.

815,453. George S. Merrill, Peace Dale, R. I. **Process of Coking.** A moving layer of coal which at all points of its travel is enclosed from contact from the air is subjected to successive degrees of heat; the gases are drawn off in the order in which they are formed and the moving layer is treated with a spray of water, the steam produced and whatever air may have entered being withdrawn by suction.

815,516. Chauncey E. Dewey, Denver, Colo. Assignor to The American Zinc and Chemical Co., Denver, Colo. **Apparatus for converting zinc sulphate solution into zinc oxide.** There are two chambers: one a calcining chamber in combination with an adjacent source of heat, and mounted so as to rotate and having the ends open; the other an evaporating chamber also mounted so as to rotate, one of its ends being adjacent to the open end of the calcining chamber remote from the source of heat. There are also means for delivering the zinc sulphate solution to the extremity of the evaporating chamber remote from the calcining chamber, and means exterior to both chambers for transferring the contents of the evaporating chamber to the calcining chamber. The axes of the rotary retorts are vertical and one is arranged above the other.

815,548. Charles Mettler, Munich, Germany. **Aromatic alcohols and their derivatives.** Aromatic esters are exposed in a dissolving agent, capable of conducting the electric current in the cathode space of an electrolytic apparatus, using for the cathode a material of a specially high cathodic tension, as lead,



then neutralizing the cathode liquid, then separating the reaction products and finally distilling.

815,600. Leon Lilienfeld, Vienna, Austria-Hungary. **Producing metallic or lustrous colors.** Metallic or lustrous colors for printing on fabrics are produced by mixing together a resinous substance and a vegetable juice substance, and combining with said mixture, a mixture comprising wood oil and a resinous substance, and then adding to the mixture thus formed the pigment. Rubber, turpentine and wood oil may be used.

815,614. August R. Meyer, Kansas City, Mo.; Emma J. Meyer, executrix of August R. Meyer, deceased. Assignor to The United Zinc and Chemical Co., Kansas, City, Mo. **Extraction of precious metals.** This is a process for extracting the precious metals from zinc ores by mixing the comminuted ore with copper, and heating the mass to sublime the zinc and form a metallic matte containing the precious metals.

815,653. Friedrich, Stolz Höchst-on-Main, Germany. Assignor to Farbwerke vorm. Meister, Lucius and Brüning, same place. **Alkylaminoacetopyrocatechol.** The radical of a primary aliphatic amine is substituted for the halogen in chloracetopyrocatechol by gently heating the latter with primary aliphatic amines, the products being white crystalline compounds, very little soluble in water, alcohol and ether, melting at a high temperature without decomposition, forming with hydrochloric acid salts easily soluble in water, crystallizing from alcohol, the aqueous solution of the salt forming with ferric chloride an emerald-green coloration, ammonia precipitating from the solution the aminoketone.

815,671. Max Becke, Höchst-on-Main, Germany. **Multi-colored dye effects.** Animal hair is treated with a tanning substance and a metallic salt and is then worked in with untreated fiber into spun goods or woven fabrics; the goods are then dyed with an acid dyestuff.

815,717. Carl Langer, Ynspenllwch, Clydach, England. Assignor to the Mond Nickel Co., Limited, Westminster, England. **Treating nickel ores.** Nickel is volatilized in the form of nickel carbonyl by passing carbon monoxide over material containing finely divided nickel while maintaining the temperature of the material at between 40° and 50°.

815,801. Charles M. Depew and Hollis E. McCoy, San Francisco, Cal. Assignors to Pumice Stone Construction Co., same place. **Building material.** Consists of volcanic pumice of nut size and containing about 20 per cent. of alumina  $2$ , scoria crushed to about the consistency of ordinary sand and containing about 27 per cent. of alumina and which, when ground, is of a dark

color, does not dust or powder, and has sharp edges and angular surfaces, and Portland cement, one part each.

815,821. Lelia E. Hathaway, Wellsboro, Pa. Administratrix of Geo. M. Hathaway, deceased. Assignor to Hathamite Co., Wellsboro, Pa. **Explosive compound.** Contains a metallic nitrate oxidizer as barium nitrate 7, paraffin 6, dinitrophenol 7, carbon  $\frac{1}{2}$ , and paraffin oil  $\frac{3}{4}$  part.

815,846. Oswald Löffler and Wilhelm Weilde, Vienna, Austria-Hungary. **Filtering material.** Finely pulverized asbestos, chalk, fossil meal and syenite are mixed with water, and the mixture pressed in molds and burned. A finely porous filter stone is the result, through which bacteria cannot pass.

815,851. Charles W. Merrill, Alameda, Cal. **Refining hydrometallurgical products.** Finely divided hydrometallurgical products are mixed with litharge and a soluble salt of lead is added to the mixture. The whole is heated to reduce the litharge and lead salt to metallic lead, replenishing the material periodically to provide fresh accretions of lead, and finally cupelling the lead off from the precious metals contained.

815,875. Otto C. Strecker, Darmstadt and Hans H. Strecker, Mainz, Germany. **Deep etching of zinc.** A plate of zinc is provided with a print or transfer and is sprinkled with asphaltum dust, and is then exposed as the anode to an electric current of at least two amperes to each square decimeter of surface while submerged in a bath of a zinc salt.

815,881. Clinton P. Townsend, Washington, D. C. Assignor to Elmer A. Sperry, Brooklyn, N. Y. **Reduction of ores.** The ore, such as lead sulphide, is floated upon a body of the molten metal which is the base of the ore, under a fused electrolyte, and is reduced by passing the electric current through it.

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815,942. James Dewar, Cambridge, England. **Absorbing gases or vapors and the production of high vacua.** Gases or vapors are exposed to and absorbed by charcoal cooled to a temperature comparable to that at which the gas or vapor to be absorbed boils. This is accomplished in an enclosed space when it is intended to produce a vacuum.

816,061. Charles E. Baker and Arthur W. Burwell, Cleveland, Ohio. **Treating ores.** Chlorine is made to react upon an ore containing a metal and metalloid, as sulphur, producing a chloride of the metal and obtaining the metalloid in the elemental state.

816,142. Robert H. Aiken, Winthrop Harbor, Ill. **Making iron from the ore.** Into a bath of a molten silicate of a metal or metals not less positive than iron is gradually fed the iron oxide to be operated upon, meanwhile maintaining the direct current through it.

816,270 and 816,271. Demetrius M. Steward, Chattanooga, Tenn. **Refractory material.** A refractory material for insulating consisting of a combination of powdered steatite 100, and water glass 20 parts or their substantial equivalents, produced by preparing a mixture of magnesium and sodium silicates, and effecting reaction therein by the application of heat at a temperature necessary to the conversion of the mixture, which may rise to 2000°.

816,314. Walter T. Griffin, Plainfield, N. J. **Making and burning fuel gas.** A mixture of superheated steam and finely divided carbonaceous material is passed through a heated zone, the formed gases are passed back through the zone to a point outside the same; a supply of oxygen is introduced into the current of the gases and the mixture conducted under the zone and burned.

816,359. August Neihardt, Albany, N. Y. **Composition of matter.** A composition for removing old paint, varnish, etc., from wood or other material consisting of cabinet makers glue 7, tallow 1, starch 2, and coloring-matter as desired.

816,389. Joseph A. Shinn, Pittsburg, Pa. **Slag cement and method of making.** Granulated basic slag 75 to 90, hydrated lime 10 to 20 and dehydrated iron oxide 3 to 15 parts are mixed together and dry-ground until at least 90 per cent. will pass through a 200-mesh screen.

816,404. Charles N. Waite, Lansdowne, Pa. Assignor by mesne assignments to Silas W. Pettit, Philadelphia, Pa. **Filaments and films from viscose.** Viscose products are initially subjected to the action of a solution comprising acid sodium sulphite and a saline dehydrating agent like ammonium sulphite.

816,457. Victor Fussgänger, Höchst-on-Main, Germany. Assignor to Farbwerke, vorm. Meister, Lucius and Brüning, same place. **Blue fibrous material.** A fibrous material of blue shade obtained by saturating the fiber with a mixture of alkylated diaminobenzhydrols and diphenylamine derivatives and oxidizing them together by oxidizing agents, such as steam and potassium chlorate.

816,497. Lewis W. Noyes, Mechanicsville, N. Y. **Paper for lithographic prints.** A preliminary sizing is first applied to the web to fill the pores and provide a homogeneous surface, and the excess of sizing solution is squeezed out. The web is then dried and next conveyed through a coating-enamel containing as an essential ingredient casein, and is then dried by hot air.

WM. H. SEAMAN.



# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

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## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Contributions to Economic Geology, 1905.** By S. F. EMMONS AND E. C. ECKEL. *U. S. Geol. Survey, Bull.* 285, 506 pp.; maps.—This is the fourth of an annual series of bulletins in which are to be found preliminary discussions of the results of extended economic investigations and comparatively detailed descriptions of occurrences of economic interest, but not of sufficient importance to necessitate a later and more extended description. Many of them contain chemical data. The papers are grouped according to subjects treated, and appended to each section is a list of previous publications by the survey. The contents, with a few exceptions, are as follows:

**Ore Deposits of Bear Creek, near Silverton, Colorado,** by W. H. EMMONS. **The Hahn's Peak Gold Field,** by H. S. GALE. **The Idaho Springs Mining District,** by G. H. GARREY. **Economic Features of Northern Idaho and Northwestern Montana,** by D. F. MACDONALD. **Notes on the Ore Deposits of Southwestern Nevada and Eastern California,** by S. H. BALL. **A Reconnaissance of the Mineral Deposits of New Mexico,** by W. LINDGREN AND L. C. GRATON. **The Annie Laurie Mine, Piute County, Utah,** by W. LINDGREN. **The Copper Mines of the United States in 1905,** by W. H. WEED. **The Cashin Mine, Montrose County, Colorado,** by W. H. EMMONS. **Ore Deposits in the St. Joe River Basin, Idaho,** by A. J. COLLIER. **Copper Deposits near Luray, Virginia,** by W. C. PHALEN. **Tin in the Franklin Mountains, Texas,** by G. B. RICHARDSON. **Investigations of Black Sands from Placer Mines,** by D. T. DAY and R. H. RICHARDS. **A Nevada Zinc Deposit,** by H. F. BAIN. **The "Clinton" or Red Ores of Northern Alabama,** by E. C. ECKEL. **The Iron Ores of Bath County, Kentucky,** by E. M. KINDLE. **The Oriskany and Clinton Iron Ores of Virginia,** by E. C. ECKEL. **The Brown Ores of the New River-Cripple**

Creek District, Virginia, by R. J. HOLDEN. Iron Ores of the Western United States and British Columbia, by C. K. LEITH. Survey Work on Coal during 1905, by M. R. CAMPBELL. The Warrior Coal Basin in the Birmingham Quadrangle, Alabama, by CHARLES BUTTS. Coal in the Mount Diablo Range, Monterey County, California, by RALPH ARNOLD. The Yampa Coal Field, Routt County, Colorado, by N. M. FENNIMAN and H. S. GALE. The Engle Coal Field, New Mexico, by W. T. LEE. The Durango-Gallup Coal Field of Colorado and New Mexico, by F. C. SCHRADER. Coal Resources of the Kenova Quadrangle, Kentucky, Ohio, West Virginia, by W. C. PHALEN. Development of the Bear Creek Coal Fields, Montana, by C. A. FISHER. The Clearfield Coal Field, Pennsylvania, by G. H. ASHLEY. The Punxsutawney and Glen Campbell Coal Fields of Indiana and Jefferson Counties, Pennsylvania, by F. B. PECK and G. H. ASHLEY. Coal in Sanpete County, Utah, by G. B. RICHARDSON. Notes on the Weber River Coal Field, Utah, by J. A. TAFF. The Book-Cliffs Coal Field, west of the Green River, Utah, by J. A. TAFF. Mineral Resources of the Bighorn Mountain Region, by N. H. DARTON. Mineral Resources of the Bighorn Basin, by C. A. FISHER. The North Dakota-Montana Lignite Area, by A. G. LEONARD. Coal and Oil in Southern Uinta County, Wyoming, by A. C. VEATCH. The Salt Lake Oil Field, near Los Angeles, California, by RALPH ARNOLD. The Nineveh and Gordon Oil Sands in Western Greene County, Pennsylvania, by F. G. CLAPP. Ozokerite Deposits in Utah, by J. A. TAFF and C. D. SMITH. Cement Resources of the Cumberland Gap District, Tennessee-Virginia, by E. C. ECKEL. Cement Resources of Washington, by HENRY LANDES. Some Magnetite Deposits of California, by F. L. HESS. The Lime Industry of Knox County, Maine, by E. S. BASTIN. Gypsum of the Uncompahgre Region, Colorado, by C. E. SIEBENTHAL. Gypsum Deposits of the Laramie District, Wyoming, by C. E. SIEBENTHAL. Clays of Garland County, Arkansas, by E. C. ECKEL. Clay Resources of Northeastern Kentucky, by W. C. PHALEN. Clays of Western Kentucky and Tennessee, by A. F. CRIDER. Clays of the Penobscot Bay Region, Maine, by E. S. BASTIN. Clays of Cape Cod, Massachusetts, by M. L. FULLER. Notes on Clays and Shales in Central Pennsylvania, by G. H. ASHLEY. Bentonite of the Laramie Basin, Wyoming, by C. E. SIEBENTHAL. Note on a Variety of Maine Slate, by T. N. DALE. The Requirements of Sand and Limestone for Glass-making, by E. F. BURCHARD. Glass Sand of the Middle Mississippi Basin, by E. F. BURCHARD. The Glass-sand Industry in Eastern West Virginia, by G. W. STOSE. Volcanic Ash near Durango, Colorado, by L. H. WOOLSEY. Graphite in Maine, by G. O. SMITH.

W. F. HILLEBRAND.

**Mineralogical Notes, III.** BY W. P. HEADDEN. *Proc. Colorado Sci. Soc.* 8, 167-182; figures.—(1) *Cassiterite* from Mecklenberg, North Carolina, free from visible tantalite or columbite. (2) *Cassiterite* from the original discovery at the Etta mine, Pennington County, South Dakota. (3) *Stream tin* from Herbert's placer, same county as 2. (4) *Cassiterite* from Samelias claim No. 3, same county as 2. Composition as follows:

	1.	2.	3.	4.	
SnO <sub>2</sub> .....	95.18	94.36	96.78	98.22	98.13
Ta <sub>2</sub> O <sub>5</sub> .....	3.82	2.42	.....	.....	.....
FeO.....	1.11	.....	.....	.....	.....
Fe <sub>2</sub> O <sub>3</sub> .....	.....	1.80	1.90	0.72	0.43
SiO <sub>2</sub> .....	.....	1.00	0.88	.....	.....
Insol. ....	.....	.....	.....	0.64	1.40
Ign .....	.....	.....	0.12	0.34	CaO trace
	100.11	99.58	99.68	99.92	99.96
Spec. grav.....	6.7671	6.6216	6.6805	7.0187	

(5) *Jamesonite* from Sheridan, same county as 2. In quartz veins. No acicular or capillary forms in samples from this locality. Insoluble, 1.13; S, 18.90; Sb, 26.99; Pb, 51.15; Fe, 1.30; Cu, 0.24; Zn, 0.05; Co, trace; total, 99.76. Sp. gr. 5.813. (6) *Meneghinite* from the Gorman claim, near Rochford, same county. Insoluble, 0.49; S, 17.51; Sb, 18.20; As, trace; Pb, 62.85; Cu, 0.86; Fe, Bi, Cd, traces; total, 99.61. Sp. gr. 6.21. (7) *Huebnerite* from the Comstock mine, Lawrence County, South Dakota. WO<sub>3</sub>, 75.12; MnO, 20.54; FeO, 3.01; CaO, 1.04; total, 99.71. In groups of black flattened radiating crystals six inches long or more. (8) *Wolframite* from Sunday Gulch, same county as 2. WO<sub>3</sub>, 74.46; MnO, 19.90; FeO, 3.29; CaO, 1.05; insoluble, 0.42; ignition, 0.75; total, 99.87. Massive, granular. (9) *Phosphorescent zinc blendes*. Two impure specimens are described, one from southeastern Utah, the other from Mariposa County, California. (10) *Tapiolite* from Custer City, South Dakota. Cassiterite, 0.31; SnO<sub>2</sub>, 0.07; WO<sub>3</sub>, 0.11; TiO<sub>2</sub>, trace; Cb<sub>2</sub>O<sub>5</sub>, 4.29; Ta<sub>2</sub>O<sub>5</sub>, 78.61; FeO, 16.85; total, 100.24. Sp. gr. 7.2185. Brief crystallographic data by S. L. Penfield seem to confirm the identification in spite of the low density.

W. F. HILLEBRAND.

**Summary of the Under-Ground Water Resources of Mississippi.** BY A. F. CRIDER AND L. C. JOHNSON. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 159*, 86 pp.; maps, plates.—The report ends with a lengthy table of analyses of well and spring waters.

W. F. HILLEBRAND.

**Underground Water Papers, 1906.** BY M. L. FULLER. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 160*, 104 pp.; figures.—The following titles of papers in this report may be mentioned, in addition to those noticed in more detail in



the next three abstracts. **Work of the Eastern Section of Hydrology in 1905, and Publications Relating to Underground Waters**, by M. L. FULLER; **Significance of the Term Artesian**, by M. L. FULLER; **Occurrence of Water in Crystalline Rocks**, by E. E. ELLIS; **Problems of Water Contamination**, by ISAIAH BOWMAN; **Instances of Improvement of Water in Wells**, by M. L. FULLER.

W. F. HILLEBRAND.

**Total Amount of Free Water in the Earth's Crust.** BY M. L. FULLER. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 160*, pp. 59-72.—Basing his calculations on certain factors of porosity, thickness and saturation of the formations of the earth's crust, the author finds that the total free water held by the crust would be equivalent to a uniform sheet over the entire surface with a depth of 96 feet "which is only about one-seventy-fifth of the amount postulated by Delesse, one-thirty-fifth of that of Schlichter, one-sixteenth to one-eighth of that of Chamberlain and Salisbury, and three-sevenths of that of Van Hise."

W. F. HILLEBRAND.

**Use of Fluorescein in the Study of Underground Waters.** BY R. B. DOLE. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 160*, pp. 73-85.—This is an account of the use of fluorescein in tracing the course of subterranean waters, the material being nearly all taken from reports and papers on work of the kind undertaken in Paris, France. A partial bibliography is appended.

W. F. HILLEBRAND.

**Peculiar Mineral Waters from Crystalline Rocks of Georgia.** BY M. L. FULLER. *U. S. Geol. Survey, Water Supply and Irrigation Paper No. 160*, pp. 86-91.—Certain wells and springs near Austell, 20 miles northwest of Atlanta, furnish waters which for crystalline rocks are enormously rich in chlorides and sulphates. The total solids vary from 2159.2 to 9058 parts per million and there is great variation also in the proportions of the principal mineral substances, sodium and chlorine predominating largely over calcium and the sulphate ion. The possible sources of mineralization are considered, but no decision is reached. Detailed analyses by Edgar Everhard of the Georgia Geological Survey accompany the paper.

W. F. HILLEBRAND.

**Report of Progress of Investigations of Mineral Resources of Alaska in 1905.** BY A. H. BROOKS AND OTHERS. *U. S. Geol. Survey, Bull. 284*, 169 pp.; maps, plates.—This, the second of a proposed series of annual publications, contains 15 papers by 13 authors. The most important papers from a chemical point of view are some of those treating of the coal resources, accompanied as they are by numerous analyses made in the laboratory of the Survey Fuel Testing Plant at St. Louis.

W. F. HILLEBRAND.

**The Waters of the Crater Lakes of Taal Volcano, with a Note on Some Phenomena of Radioactivity.** BY R. F. BACON. *Philippine J. Sci.* **1**, 433-437.—The volcano of Taal rises from a lake in the Province of Batangas, Luzon. In the crater itself are two pools known as the Green and Yellow Lakes, respectively, from the color of their waters. Analyses 1 and 2 represent in grams per liter the essential data as to the composition of these waters in January, 1906, and 3 that of the outside lake at a date about two years earlier. (The originals are in parts per 100 cc.).

	1. Green.	2. Yellow.		3 Outer lake.
Ca .....	0.934	1.042	Ca.....	0.05339
Mg.....	9.432	18.210	Mg.....	0.04942
K.....	0.418	0.514	Na.....	0.45634
Na.....	17.217	9.343	Fe <sub>2</sub> O <sub>3</sub> }	0.0042
Fe'' .....	7.150	13.250	Al <sub>2</sub> O <sub>3</sub> }	
Fe''' .....	3.160	3.860	SO <sub>4</sub> .....	0.1913
Al .....	11.892	34.850	Cl.....	0.720
SO <sub>4</sub> .....	41.303	56.768	SiO <sub>2</sub> .....	0.0315
Cl.....	63.143	112.760	CO <sub>2</sub> as bicarb.....	Considerable
PO <sub>4</sub> .....	0.273	0.391	Free NH <sub>3</sub> .....	trace
Sediment.....	0.634	45.940	Nitrites.....	traces
Acidity.....	1.28 N	2.08 N		
Spec. grav., 15° C....	1.1062	1.1763		

The water of the outer lake is slightly alkaline and holds a slight whitish deposit. Analyses of the pool waters made by Jose Centeno in 1885 show less acidity and lower concentration. It was noticed in testing the waters for radioactivity that the normal rate of discharge of the electroscope was much influenced by the intensity of the daylight illumination, being very great in direct sunlight and extremely slight in total darkness. The pool waters when analyzed some weeks after collecting showed no evidence of radioactivity, but the experiments will be repeated on fresh samples. W. F. HILLEBRAND.

**Preliminary Report on the Operations of the Fuel Testing Plant of the United States Geological Survey at St. Louis, Missouri, 1905.** J. A. HOLMES IN CHARGE. *U. S. Geol. Survey, Bull.* **290**, 240 pp.—The greater part of this report is taken up with analyses and results of tests relating to washing, steaming, coking, briquetting, and the production of producer gas made on a large number of coals from many states. In the brief report on the work of the chemical laboratory, by N. W. Lord, certain important changes in the manner of drying and pulverizing samples for analysis are briefly outlined. These will receive more extended notice when the complete report appears. W. F. HILLEBRAND.

**A Summary of Lake Superior Geology with Special Reference to Recent Studies of the Iron-Bearing Series.** BY C. K. LEITH. *Trans. Am. Inst. Min. Eng.* **36**, 101-153; map, figures.—

The material of this paper has been covered in large part by previous abstracts.

W. F. HILLEBRAND.

**Salt Deposits and the Salt Industry in Ohio.** By J. A. BOWNOCKER. *Ohio Geol. Survey, Fourth Series, Bull. 8*, 42 pp.; figures.—The old salt industry in Ohio is practically extinct, but a new one on a wholly different basis has sprung up in the northeastern part of the state that seems open to indefinite expansion. Analyses of brines and of salt by C. W. Foulk accompany the report, which closes with a brief outline of the analytical methods employed.

W. F. HILLEBRAND.

**New Forms of Concretions.** By H. W. NICHOLS. *Pub. Field Columbian Mus. Geol. Series, 3*, 25-54; plates.—The forms described are those of sand-calcite from Salton, California, sand-barite from eastern Oklahoma (analysis), limonite-sand from Spring Lake, Michigan, limonite geodes from Muscogee, Indian Territory, and from the Ohio River, 30 miles from Owensboro, Kentucky, and nodules from the Challenger and Argus Banks near the Bermudas. The description with analysis of these last is coupled with an argument as to their probable mode of formation and that of dolomites and dolomitic limestones in general. "If under present conditions corals, etc., secrete skeletons which may contain over 10 per cent. carbonate of magnesia, may they not, under palaeozoic conditions, when, as is usually conceded, the sea-water was very different in composition and possibly far more corrosive than at present, have protected themselves by secreting relatively insoluble dolomite skeletons?" The paper closes with a section on the specific gravity of claystones, in which an apparent relationship between density and relative thickness is shown to exist.

W. F. HILLEBRAND.

**Zoisite from Lower California.** By O. C. FARRINGTON. *Pub. Field Columbian Mus. Geol. Series, 3*, 55-57; plate.—The zoisite described is from the Trace mine in the Juarez District of Lower California, about 60 miles south of the international boundary. It is characterized by unusual features, which are a radiating habit, a high content of water and iron, and association with prehnite. The composition (analysis by H. W. Nichols) is:  $\text{SiO}_2$ , 38.15;  $\text{Al}_2\text{O}_3$ , 29.50;  $\text{Fe}_2\text{O}_3$ , 4.60;  $\text{MnO}$ , 0.55;  $\text{CaO}$ , 22.71;  $\text{MgO}$ , 0.63;  $\text{H}_2\text{O}$ , 3.76;  $\text{K}_2\text{O}$ ,  $\text{Na}_2\text{O}$ , traces; total, 99.90. This leads to the formula  $\text{H}_4\text{Ca}_4\text{Al}_6\text{Si}_6\text{O}_{27}$ , showing one molecule of water more than that usually ascribed to zoisite. Over half of the water is given off only at an extremely high temperature. Hardness, 6.5; sp. gr., 3.32; fusibility, 3; intumescent to a brown enamel. Only slightly attacked by hydrochloric acid.

W. F. HILLEBRAND.

## I. Contribution to the Classification of the Amphiboles. II.



**On Some Glaucophane Schists, Syenites, Etc.** BY G. MURGOCI. *Bull. Dept. Geol. Univ. California*, 4, 359-396; figures.  
W. F. HILLEBRAND.

**Notes on the Foothill Copper Belt of the Sierra, Nevada.** BY A. KNOPF. *Bull. Dept. Geol. Univ. California*, 4, 411-423.—Although the belt shows no great unity as a metallographic province "the copper deposits are all closely associated with the meta-andesites and belong to the general type of replacement deposits along shear zones." "The replacement has been equally thorough in very diverse rocks."

W. F. HILLEBRAND.

**An Alteration of Coast Range Serpentine.** BY A. KNOPF. *Bull. Dept. Geol. Univ. California*, 4, 425-430.—Near North Berkeley, California, occur extensive masses of a silica-carbonate rock which has been derived from an original bronzite by hydrometamorphism, effected by solutions highly charged with carbon dioxide, and carrying calcium carbonate and metallic sulphides.

W. F. HILLEBRAND.

**Are the Quartz-Veins of Silver Peak, Nevada, the Result of Magmatic Segregation?** BY JOHN B. HASTINGS. *Trans. Am. Inst. Min. Eng.* 36, 647-654.—In opposition to Spurr's view (*U. S. Geol. Survey Bull.* 225, this Journal, 26, R 239, and 28, R 5) the author concludes that "the veins are not siliceous segregations from the granite, but have been formed in the usual manner by ascending waters along lines of fracturing."

E. C. SULLIVAN.

**The Copper Deposits of San Jose, Tamaulipas, Mexico.** BY J. F. KEMP. *Trans. Am. Inst. Min. Eng.* 36, 178-203.—"The most important copper mineral is chalcopyrite, quite invariably in association with pyrite." "The usual oxidized compounds, malachite, chrysocolla, and, less often, cuprite, may be seen." The mine waters have copper salts in solution. The method of formation of the contact zone of garnet is discussed.

E. C. SULLIVAN.

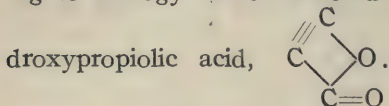
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## ORGANIC CHEMISTRY.

**The Constitution of Tribenzoylenebenzene.** BY ARTHUR MICHAEL. *Ber.* 39, 1908-1915.—The formula originally assigned to this body, the product of the action of sulphuric acid on phthalylacetic acid, is proven to be the correct one. The truxene derivative, "diphenyltetrenedicarbonic acid," thought to be identical with the phenyltribenzoic acid obtained from tribenzoylenebenzene, is proven not to be so. Also, this truxene derivative is not a derivative of tetrene but really 1-phenyl-2,3-naphthalene dicarbonic acid.

V. J. CHAMBERS.

**The Constitution of Carbon Suboxide.** BY ARTHUR MICHAEL. *Ber.* 39, 1915-1916.—The formula given by Diels and Wolf assumes that the splitting off of alcohol from the ester of malonic acid takes place in a symmetrical manner. The author believes that such is not the case, as in other known instances the splitting is asymmetrical when the formation of a ring is possible. According to analogy carbon suboxide should be the lactone of  $\beta$ -hydroxypropionic acid,



V. J. CHAMBERS.

**The Principle of Partition.** BY ARTHUR MICHAEL. *Ber.* 39, 2138-2143.—A general article regarding the relative amounts of isomers caused by a relative apportionment of the parts of a compound added to an unsaturated compound. Three general classes are considered: (A) When addenda are used whose parts are polarically different from those of hydriodic acid, such as chlorine bromide and chlorine iodide. The nearer the parts are alike the more nearly equal are the amounts of the two isomers formed. (B) When the same addenda are used, but the compounds differ in their degree of unsaturation. (C) When the same addenda are used on homologues of propylene. The general conclusion, in this latter case, is that the substitution of a hydrogen atom attached to a carbon atom by a radicle causes a relative change of the positive or negative energy of the remaining atoms of the molecule according as the introduced radicle has a positive or negative character as compared with the replaced hydrogen. If it has positive action, it increases the combining power of the carbon atoms to such atoms as are relatively negative to carbon, while the affinity to relatively positive hydrogen is diminished.

V. J. CHAMBERS.

**The Use of the Partition Principle. I. The Addition of Water to  $\Delta^{\beta}$ -Hexine.** BY ARTHUR MICHAEL. *Ber.* 39, 2143-2148.—According to the above principle both the  $\beta$ -hexanone and  $\gamma$ -hexanone should be formed by the action of sulphuric acid on  $\Delta^{\beta}$ -hexine. Previous work had indicated that only  $\beta$ -hexanone was formed but the author shows that both are produced. Separation by means of acid sodium sulphite gave negative results, shown to be due to the fact that, while  $\gamma$ -hexanone, in a pure state, gave no precipitate and dissolved but slowly in the reagent, the presence of  $\beta$ -hexanone caused all to go into solution at once. A good method of separation was found that depended on the fact that  $\beta$ -hexanone forms a semicarbazone with hydrogen semicarbazide phosphate while the other hexanone does not.

V. J. CHAMBERS.

**The Use of the Partition Principle. II. The Constitution of the Hexyl Alcohol Obtained from Mannite-Hexene.** BY ARTHUR MICHAEL AND ROBERT N. HARTMAN. *Ber.* 39, 2149-2152.—The hexyl alcohol obtained by the addition of water to mannite-hexene is really a mixture of  $\beta$ - and  $\gamma$ -hexanols containing about 77 parts of the first and 23 parts of the latter. The results were obtained by carefully oxidizing the alcohol to the ketone mixture which was then separated by the semicarbazide method. A point of further interest to the above principle is that direct oxidation of the hexene gave a mixture of the ketones containing 55 parts of the  $\beta$ -ketone to 45 parts of the  $\gamma$ -body. These results are in accord with the theory as the change of entropy in the direct formation of the ketones should be greater than in the formation of the carbinols. V. J. CHAMBERS.

**The Use of the Partition Principle. III. Action of Chlorine on Hexane.** BY ARTHUR MICHAEL AND HAROLD J. TURNER. *Ber.* 39, 2153-2156.—The first stage in the action of halogen on normal hexane should be the formation of a "larger" halogen-hexane molecule which should then give 1-, 2- and 3-halogen hexane. The relative amounts of each can be derived by the use of the above principle and they were found to agree with the actual results obtained. V. J. CHAMBERS.

**The Use of the Partition Principle. IV. Addition of Hypochlorous Acid to Isobutylene.** BY ARTHUR MICHAEL AND VIRGIL L. LEIGHTON. *Ber.* 39, 2157-2163.—The authors have previously shown that the addition of hypochlorous acid to propylene gives  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{Cl}$ . They now show that the addition of this acid to isobutylene gives almost entirely  $(\text{CH}_3)_2\text{CH}(\text{OH})\text{CH}_2\text{Cl}$ , and they state as a general rule that the addition of hypochlorous acid to  $\alpha$ -alkenes gives chlorhydrins that have the chlorine atom on the end one of the previously unsaturated carbons. This result appears not to be in accord with the positive negative addition law nor with the principle of partition, as the  $\beta$ -carbon atom, being the more positive, should get the halogen atom. Also, hydroxyl and chlorine, being not far separated in polarity, should give a mixture of isomers. However, this can be accounted for when one considers that the addition takes place in water solution so that the addenda are really the dissociated parts H and OCl. It may be that the addition takes place in the following stages:  $\text{C}_n\text{H}_{2n-1}\text{CH}:\text{CH} + \text{HOCl} = \text{C}_n\text{H}_{2n-1}\text{CHOC}(\text{H})\text{CH}_2\text{H} \Rightarrow \text{C}_n\text{H}_{2n-1}\text{CH}(\text{OH})\text{CH}_2\text{Cl}$ . *Isobutylene chlorhydrin* is a colorless oil boiling at  $128^\circ$  (corr.) and possessing a specific gravity of 1.0663 at  $20^\circ$ . V. J. CHAMBERS.

**Use of the Partition Principle. V. The Course of Reaction when Mixed Ethers are Decomposed with Hydriodic Acid.** BY ARTHUR MICHAEL AND FRANCIS D. WILSON. *Ber.* 39, 2569-

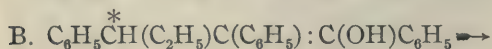
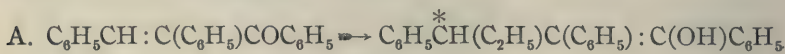


2577.—There are two energy factors to be considered in the action of hydriodic acid on methylpropyl ether. Little energy is necessary to separate oxygen from methyl as compared with oxygen from propyl. On the other hand, the heat of formation of propyl iodide is greater than that of methyl iodide. The data at hand are not sufficient to tell beforehand which direction the reaction will take. Experiment showed a large proportion of methyl iodide and a small but sure quantity of propyl iodide. The difference between methyl and propyl with regard to both of the above factors is greater than that between ethyl and propyl. Therefore, according to the partition principle, more nearly equal amounts of ethyl iodide and propyl iodide should be obtained but with the ethyl iodide still in excess. About twice as much ethyl iodide as propyl iodide was obtained. Silva and Lippert had claimed that the action of hydriodic acid on propyl-isopropyl ether gave a mixture of propyl alcohol and isopropyl iodide. According to the partition principle, a mixture of the two iodides should be obtained. Such was found to be the case.

V. J. CHAMBERS.

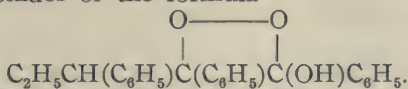
**The Reaction between Unsaturated Compounds and Organic Magnesium Compounds. IX. Reactions with Stereoisomers.**

By E. P. KOHLER. *Am. Ch. J.* **36**, 177-195.—When substances containing two asymmetric carbon atoms are obtained by the addition of Grignard's reagent to unsaturated compounds, the asymmetry is established in steps:



The possibilities in the course of the reaction are as follows: (1) The addition of the reagent results in the formation of two ethylene isomers which, on rearrangement, pass into the corresponding optical antipodes. The direct product of addition would, in this case, contain four substances, because each ethylene isomer would be a racemic modification containing one asymmetric carbon atom. (2) The addition product contains but one racemic ethylene derivative, the two components forming two pairs of antipodes during rearrangement. (3) The entire reaction results in but one racemic modification, the second being due to autoracemization, which takes place very readily when an asymmetric carbon atom holds mobile hydrogen. Ethyl magnesium bromide and the two isomeric unsaturated ketones, benzal and isobenzaldehydoxybenzoin, gave the same product, which, on hydrolysis, gave a mixture of the two racemic modifications of diphenylbutyrophenone, but, as the relative amounts of the

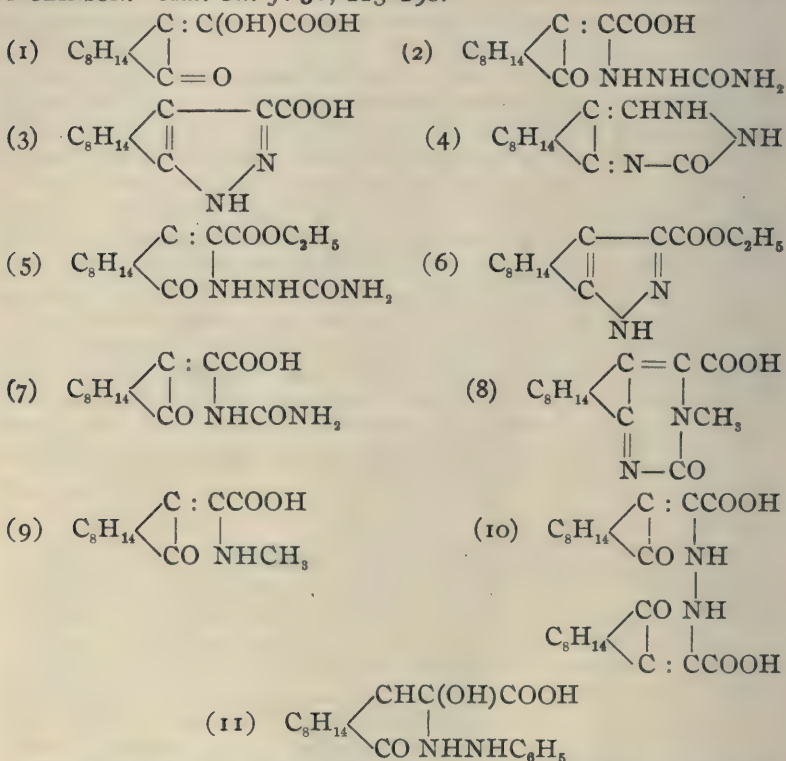
two isomers depend on the mode of hydrolysis, it is probable that but one substance is formed in the process B. In the case of tetraphenylpropenol it was possible to isolate the enolic form in crystalline condition and in the other cases they could be detected in solution. These unsaturated alcohols show a pronounced tendency to combine with free oxygen and form peroxides. EXPERIMENTAL. — *Triphenylpentenyl Benzoate*,  $C_2H_5CH(C_6H_5)C(C_6H_5):C(C_6H_5)OCOC_6H_5$ , was obtained by the action of benzoyl chloride on the reaction product of either ketone with ethyl magnesium bromide; long needles, melting at  $143^\circ$ , soluble in acetone, chloroform, and boiling alcohol, sparingly in cold alcohol and ligroin. It is easily hydrolyzed. *Triphenylpentenyl Acetate*,  $C_2H_5CH(C_6H_5)C(C_6H_5):C(C_6H_5)OCOCH_3$ , was obtained from both ketones in a similar manner. Fine needles, melting at  $120^\circ$ , readily soluble in acetone, chloroform and boiling alcohol. An oil, probably triphenylpropenol, was obtained by careful hydrolysis of the magnesium derivative. It changed readily to the low-melting isomer of diphenylbutyrophene. It absorbed oxygen readily, forming two crystalline bodies, one melting at  $166^\circ$  and the other at  $110^\circ$ ; analysis and properties indicated isomeric peroxides of the formula



The peroxides from triphenylpentenol are stable substances. They do not give the usual peroxide reactions with water, iodides, or indigo. When heated in quantity they decompose with a flash, but no detonation, giving ethyldesoxybenzoin and benzoic acid. The presence of hydroxyl in the peroxides was established by their action with ethyl magnesium bromide. *Tetraphenylpropenol*,  $(C_6H_5)_2CHC(C_6H_5):C(OH)C_6H_5$ , was obtained when phenyl magnesium bromide was used and the hydrolysis carried out with care. It crystallizes from ligroin in colorless needles, readily soluble in alcohol and ether, sparingly in ligroin. The melting-point depends on the rate of heating and is between  $95^\circ$  and  $100^\circ$ . *Tetraphenylpropenol Peroxide* crystallizes in small lustrous prisms melting at  $127^\circ$ , soluble in alcohol, ether, chloroform and acetone. When heated by itself or with hydrochloric acid, it decomposes to benzoic acid and diphenylacetophenone. The latter was shown to be diphenylacetophenone by the fact that it reacted with Grignard's reagent as a ketone and by the formation of *diphenylacetophenone oxime*,  $(C_6H_5)_2CHC(C_6H_5):NOH$ , melting at  $182^\circ$ , soluble in acetone, sparingly in alcohol. *Bromotriphenylpropiofenone*,  $(C_6H_5)_2CHCBr(C_6H_5)COC_6H_5$ , was obtained by treating the magnesium derivative of tetraphenylpropenol with bromine; large prisms, m. p.  $124^\circ$ , soluble in chloroform and acetone, very sparingly so in alcohol.

V. J. CHAMBERS.

**A Continuation of the Study of the Action of Amines on Camphoroxalic Acid.** BY J. BISHOP TINGLE AND CHARLES J. ROBINSON. *Am. Ch. J.* **36**, 223-290.



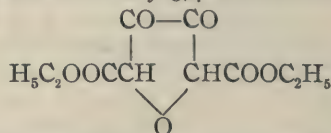
The amines used were semicarbazine, urea and the methylated ureas, hydrazine, phenylhydrazine, and *p*-bromophenylhydrazine. The results obtained were in further confirmation of the keto-enolic structure already assigned to camphoroxalic acid (1). *Action of Semicarbazine.*—The isomeric bodies supposed to be produced in this reaction were shown to be identical. Carbamylcamphoformeneaminecarboxylic acid (2), m. p. 198°, was the one substance obtained. Camphoroxalic acid and semicarbazine, under pressure, at 125°, gave hydrazodicarbonamide, and *camphylpyrazolecarboxylic acid* (3), m. p. 255-258°. Fusion of (2) gave hydrazodicarbonamide, camphylpyrazolecarboxylic acid, and *camphyl-3-keto-1,2,4-heptatriazine* (4), yellow needles melting at 305-306°. Dry hydrogen chloride on an alcoholic solution of (2) at 0° gave ethyl carbamylcamphoformeneaminecarboxylate (5) melting at 191°. On standing in its mother-liquor, this ester decomposed, giving *ethyl camphylpyrazolecar-*



boxylate (6), m. p. 91–92°. This ester (6) is strongly basic and forms a stable hydrochloride, m. p. 156°. *Action of Urea and Methylated Ureas.*—Camphoroxalic acid and urea, in alcoholic solution, at 135°, under pressure, gave *formamidylcamphoformeneaminecarboxylic acid* (7), m. p. 192–194°. Camphoroxalic acid and methylurea gave *1-methyl-2-keto-4,5-camphylmetadiazine-6-carboxylic acid* (8), yellow prismatic crystals melting at 154°. Symmetrical dimethylurea produced a tarry mass from which small quantities of a body melting at 104–105° and a larger amount of a second compound proved to be *methylcamphoformeneaminecarboxylic acid* (9), m. p. 77–78° were obtained. *Action of Hydrazine.*—A methyl alcoholic solution of hydrazine acted on camphoroxalic acid giving three substances, *hydrazine camphoroxalate*, decomposing at 186°, *biscamphoformeneaminecarboxylic acid* (10), decomposing at 150–155°, and *camphylpyrazolecarboxylic acid* (3). A substance that did not melt up to 288°, possibly *camphylpyrazole*, was obtained by fusing (3). *Biscamphoformeneaminecarboxylic acid* when fused gave three products, two isomeric compounds melting at 223° and 232° respectively, composition  $C_{24}H_{30}O_6N_2$ , and another compound,  $C_{24}H_{30}O_5N_2$ , yellow prisms melting at 221°. *Action of Phenylhydrazine.*—Phenylhydrazine and camphoroxalic acid or its potassium salt gave a stable addition product (11), fine yellow needles, m. p. 120°. The possibility of its being a salt is excluded by its formation from potassium camphoroxalate. When this body (11) is boiled for some time with alcohol, or fused, it condenses to *camphylphenylpyrazolecarboxylic acid*. *Action of Parabromphenylhydrazine.*—Five derivatives were obtained. (1). An addition compound analogous to (11), yellow needles melting at 149°. (2) A second compound melting at 172° containing one  $H_2O$  less than 1. (3) *Camphyl-p-bromphenylpyrazolecarboxylic acid*, minute colorless needles melting at 215°. (4) *Ethylcamphyl-p-brompyrazolecarboxylate*, triclinic crystals melting at 107°. (5) A compound not analyzed but probably *camphyl-β-brompyrazole*. The facts brought out by this work that tend to confirm the unsaturated hydroxy structure for camphoroxalic acid (I) are the following: Methylurea reacts readily with it, more readily than urea itself, both primary and secondary amine groups entering into the condensation, forming a metadiazine derivative. Phenylhydrazine and *p*-bromphenylhydrazine both give addition products more stable than products from true ketones. *p*-Bromphenylhydrazine gives a ring compound in which both the keto (or the keto and the enolic) groups have reacted, but with the elimination of only one molecule of water. V. J. CHAMBERS.

**Researches on Furfurans: On 2,5-Dicarbethoxy-3,4-Diketotetrahydrofurfuran.** I. BY TREAT B. JOHNSON AND CARL O. JOHNS. *Am. Ch. J.* 36, 290–294.—Diethyl oxalate and diethyl

diglycollate were condensed by means of sodium ethylate to the sodium salt of 2,5-dicarbethoxy-3,4-diketotetrahydrofurfuran.



The free ester crystallizes as stout prisms melting at  $189^\circ$ . The sodium salt is a white microscopic powder.

V. J. CHAMBERS.

**Ortho-, Meta-, and Paraiodohippuric Acids.** BY TREAT B. JOHNSON AND HAROLD A. MEADE. *Am. Ch. J.* **36**, 294-301.—Ortho-, meta- and paraiodohippuric acids and some of their derivatives were prepared and studied. Also, some derivatives of 3,5-dinitrobenzoic acid. *o*-Iodohippuric acid,  $\text{C}_6\text{H}_4\text{I}(\text{CONHCH}_2\text{COOH})$ , obtained by the action of *o*-iodobenzoyl chloride on aminoacetic acid, crystallizes in radiating needles and melts at  $167^\circ$ . *o*-Iodobenzoylaminoacetoneitrile,  $\text{IC}_6\text{H}_4\text{CONHCH}_2\text{CN}$ , by the action of the same acid chloride on aminoacetoneitrile under proper conditions, crystallizes in prisms, m. p.  $158^\circ$ . *Ethyl-o*-iodohippurate, prisms, m. p.  $79-80^\circ$ . *p*-Iodobenzoyl chloride gave a like series. *p*-Iodohippuric acid, plates, m. p.  $193^\circ$ . *p*-Iodobenzoylaminoacetoneitrile, prismatic crystals, m. p.  $191-192^\circ$ . *Ethyl-p*-iodohippurate, plates, m. p.  $128-129^\circ$ . *Di-p*-iodobenzoylaminoacetoneitrile, prisms, m. p.  $215-216^\circ$ . *m*-Iodohippuric acid, by the action of potassium iodide on *m*-diazohippuric acid, crystallizes from water in scales melting at  $155-156^\circ$ . The substituted amides given below were all prepared by the action of the amine on the acid chloride. *p*-Iodobenzoylanilide,  $\text{IC}_6\text{H}_4\text{CONHC}_6\text{H}_5$ , m. p.  $210^\circ$ . 3,5-Dinitrobenzoylanilide,  $(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CONHC}_6\text{H}_5$ , needle-like prisms, m. p.  $234-235^\circ$ . 3,5-Dinitrobenzoylparatoluidide,  $(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CONHC}_6\text{H}_4\text{CH}_3$ , does not melt below  $280^\circ$ . 3,5-Dinitrobenzoylorthotoluidide,  $(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CONHC}_6\text{H}_4\text{CH}_3$ , m. p.  $241-242^\circ$ . 3,5-Dinitrobenzoylmethylanilide,  $(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CONHCH}_3$ , prismatic crystals, m. p.  $155-156^\circ$ . 3,5-Dinitrobenzoyldiphenylamine,  $(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CON}(\text{C}_6\text{H}_5)_2$ , prisms, m. p.  $180-181^\circ$ . 3,5-Dinitrobenzoyl- $\alpha$ -naphthalide,  $(\text{NO}_2)_2\text{C}_6\text{H}_3\text{CONHC}_{10}\text{H}_7$ , m. p.  $268^\circ$ .

V. J. CHAMBERS.

**The Formula of Curcumin.** BY C. LORING JACKSON AND LATHAM CLARK. *Ber.* **39**, 2269-2270.—The formula  $\text{C}_{21}\text{H}_{20}\text{O}_6$  proposed by Ciamician and Silber rests on certain methoxy determinations. The authors have repeated this work arriving at the conclusion that  $\text{C}_{14}\text{H}_{14}\text{O}_4$  is the correct formula. When the temperature of the bath did not rise above  $120^\circ$  the result tained indicated  $\text{C}_{14}\text{H}_{14}\text{O}_4$ , but when the temperature was allowed to reach  $200^\circ$  the results indicated  $\text{C}_{21}\text{H}_{20}\text{O}_6$ . This was shown

to be due to the fact that the higher temperature caused more deep-seated changes, giving a distillate that was not methyl iodide.

V. J. CHAMBERS.

**The Relations between Structure and Smell in Organic Compounds.** BY GERTRUD WOKER. *J. Physik. Chem.* **10**, 455-473. —Some of the conclusions reached are as follows: Saturated compounds possess little odor, the odor increasing with the degree of unsaturation. The odor is increased by overloading a carbon atom with identical groups. Sometimes a combination of groups may nullify the smell, even when each group by itself would increase it.

V. J. CHAMBERS.

## PHARMACEUTICAL CHEMISTRY.

**Comments upon the U. S. P. Inorganic Chemicals.** BY PROF. VIRGIL COBLENTZ. *Am. J. Pharm.* **78**, 303 (1906).—The author states that in 1900 when the standard of atomic weights was adopted that the question was in a very unsettled condition, and  $H=1$  was selected as it had been used in all previous editions and was also preferred by the majority of teachers and chemists. Owing to the manufacture of many chemicals by electrolytic methods, purer products are now obtainable, especially in the case of alkalies, alkaline earths and acids, which has permitted the raising of the standard of purity for all chemicals derived directly or indirectly from these. In many cases the tests of the previous revision were not uniform, and in some cases unnecessarily sensitive. In order to avoid misconstruction and secure uniformity the purity rubric was adopted for all inorganic chemicals, and innocuous impurities were ignored. The flame test for sodium in all potassium salts was dropped. For convenience and accuracy in weighing salts, without very sensitive balances, the amounts to be taken for quantitative estimation are given in even numbers, instead of numbers represented by their molecular weights. The tests for the presence of poisonous metals were revised, especially in chemicals which are administered in large doses, and extending over a long period of time, such as, sodium phosphate, hyposulphite, sulphite, etc. The old test for poisonous and undesirable metallic impurities has been replaced by the time limit test, the limit of which is intended to be about 1 part in 100,000. The author gives the test as follows: "A solution of the salt or acid in distilled water (1 in 20), when the former is slightly acidulated with an acid, should not be colored or rendered turbid by an equal volume of freshly prepared hydrogen sulphide test solution, after standing well-stoppered in a warm place at least half an hour, either before or after the addition of ammonia water to slight alkalinity. After the lapse of half an hour and before the addition of ammonia water, the mixture



should possess the distinct odor of hydrogen sulphide, if not, it should be thoroughly saturated with the gas and again set aside for half an hour." *Arsenic Tests*.—The author discusses at some length the tests for arsenic, especially those of the old Pharmacopoeia, the limit of which he gives as follows: Berzelius, limit 0.001 mg.  $\text{As}_2\text{O}_3$ , Gutzeit silver, limit 0.001 mg.  $\text{As}_2\text{O}_3$ ; Gutzeit mercuric chloride, limit 0.002 mg.  $\text{As}_2\text{O}_3$ ; Bettendorf's, limit 0.1 mg.  $\text{As}_2\text{O}_3$ . The author calls attention to the estimate of Hehner, that the 1,000,000 tons of sulphuric acid produced annually in England contain 1,800 of arsenious acid, and as this is employed in the manufacture of acids and chemicals it is important that a reliable test should be used. On page 387 the author states that the strength of sulphuric acid has been retained at 92.5 per cent. because it is the strength used in the arts and adopted by the manufacturing chemists' association. The loss of platinum during concentration of sulphuric acid to 92.5 per cent. is only one-fourth what it is during concentration to 95 per cent. The author explains that the reason for adding sodium chloride to phosphoric acid before titrating is that, "when titrating phosphoric acid under ordinary conditions the end-reaction is not sharp, phenolphthalein giving a rose tint when two-thirds of the acid has been neutralized, thus:  $\text{H}_3\text{PO}_4 + 2\text{NaOH} = \text{Na}_2\text{HPO}_4 + 2\text{H}_2\text{O}$ . According to the phenolphthalein reaction, di-sodium phosphate is slightly alkaline. If, however, this solution is diluted, the color disappears, for dissociation (hydrolysis) takes place as follows:  $\text{Na}_2\text{HPO}_4 - \text{HOH} = \text{NaOH} - \text{NaH}_2\text{PO}_4$ . In order to suppress this hydrolysis, a slight excess of sodium chloride is added. The end-point of titration is then very sharp." He reviews the methods for the manufacture of sulphurous acid, which were tried by the committee, and also the present method of assay, by adding an excess of iodine and titrating back with thiosulphate; this he finds to give very good results. Potash alum was retained because ammonia alum is seldom manufactured, and soda alum is so soluble that it does not crystallize readily, therefore difficult to purify. *Arseni Iodidum*.—The author states that the commercial article is very impure and should be purified by powdering and extracting with chloroform or carbon disulphide, or even water.

A. B. STEVENS.

**Analyses of Jalap.** BY RUSSELL W. MOORE. *J. Chem. Ind.* 25, 627 (1906).—The author reports upon the analyses of 276 samples of jalap, which gave: Minimum, 2.10 per cent.; maximum, 15.63 per cent.; average, 5.95 per cent. In a previous paper he reported an average of 12.60 per cent. of resin from 98 samples.

A. B. STEVENS.

**Additional Analyses of Asafoetida.** BY RUSSELL W. MOORE. *J. Chem. Ind.* 25, 627 (1906).—The author reports upon the analyses of 142 samples of asafoetida: Minimum, 9.35 per cent.; maximum, 65.15 per cent.; average, 31.45 per cent. Only 15.49 per cent. of the samples contained the 50 per cent. of resin required by the treasury regulations. Some of the samples consisted of impure gypsum cemented together with resin of asafoetida.

A. B. STEVENS.

## SANITARY CHEMISTRY.

**Report of the Board of Advisory Engineers of the Sewage Commission of Baltimore.** BY RUDOLPH HERING, SAMUEL M. GRAY AND FREDERIC P. STEARNS. *Eng. Record*, 54, 101-105, 129-134.—By the legislative act under which the sewerage system for Baltimore is established, it is demanded that the treatment shall be such that the effluent shall have "the highest practicable degree of purity." This has been construed that the effluent must be not only clear and non-putrescible, but practically free from bacteria. The report, after discussing various methods of treatment as intermittent filtration through natural sand beds, through artificial sand beds and contact bed treatment, and showing that the first two methods are not advisable for the treatment of Baltimore sewage on account of lack of suitable sand areas, recommends, as the method of treatment, passing the sewage successively through septic tanks, sprinkling filters, settling basins and then intermittently through artificial sand filters. The sewers of Baltimore are to be constructed on the separate system, and the plan proposed contemplates the treatment of 75,000,000 gallons daily. Open septic tanks holding eight hours' storage, gross capacity 25,000,000 gallons, maximum depth 12 feet, and having an area of 400 by 800 feet, giving a rate of flow about 10 inches per minute. To facilitate a uniform hourly rate of flow as possible, the depth of sewage is to be allowed to fluctuate between 12 and 9 feet, and to facilitate operations when the works are first built, and in order to allow of portions of the tanks being conveniently cleaned, the tanks to be divided into five compartments. Sprinkling filters, 30 acres, concrete bottoms, about 6 inches in thickness, slope 1 foot in 60 toward the underdrains. A drainage system on top of concrete, half-round pipe with open joints, or specially constructed tile. Over the drains a thin layer of coarse stone and 9 feet of broken stone of such a size that the stones can pass through a 2½-inch, and none through a 1-inch ring. Rate of filtration 2,500,000 gallons per acre daily. Allowing sewage flow of 125 gallons per capita daily, this equals about one acre of filtering surface for 20,000 persons. Settling basins, 11,000,000 gallons capacity,

average depth 10 feet, holding three hours' flow. The effluent from these basins would be fairly clear, containing only 30-40 parts per million of finely suspended matter, and be non-putrescible, and if emptied into Back River would not cause offense and as under usual conditions it would require several weeks to reach the mouth of the river, it would not be dangerous to the oyster beds of Chesapeake Bay. Still it can be, if desired, further purified so as to remove the bacterial content by intermittent filtration through artificial sand beds, 100 acres, at the rate of 750,000 gallons per acre daily. The total cost of plant, exclusive of land, \$3,283,250.00. Annual operation, \$115,500. Total cost, not including supplementary intermittent filtration, \$2,242,500. Annual operation, \$60,500. In estimating cost of annual operation it is considered that the filling material of the sprinkling filters must be washed clean once in ten years. In respect to the action of the septic tanks and the disposal of sludge, the report states: "With sewage of the composition estimated for Baltimore, there would be deposited upon the bottom of the tanks in the neighborhood of 6 cubic yards of sludge per million gallons of sewage in which there would be 90 per cent. or more of water. With favorable management the tanks may be operated so that this sludge will be reduced by bacterial action about one-half and still further consolidation in the tank to about 2 cubic yards per million gallons. The amount of water in the septic sludge would then be about 85 per cent. The tanks should be cleaned so far as practicable after or toward the end of a period of maximum bacterial activity when the organic matter of a putrefying nature is reduced to a minimum. In order to obtain the conditions above stated, namely, to have the sludge removed when the putrefactive process is practically completed and not in active operation, crude sewage should not be allowed to enter the septic tank for some time prior to the cleaning of it."

LEONARD PARKER KINNICUTT.

**The Disposal of Sewage of Paterson.**<sup>1</sup> BY ALLEN HAZEN. *Eng. Record*, 54, 144-146, 175-178.—The report states that if a full, just and lawful arrangement with the other municipalities upon the Passaic River is reached, acceptable to the Legislature, by which a trunk sewer for the entire sewage of the Lower Passaic Valley district requiring sewage disposal facilities can be built to a point where sufficient sea-water dilution exists, either in New York Bay or Newark Bay near the Kill von Kill, so that the sewage can be discharged practically untreated, such an arrangement is substantially better for Paterson than separate local purification. If, however, serious obstacles to this arrangement

<sup>1</sup> Report of Mr. Hazen to the Aldermen's Committee of the City Council of Paterson.



should be found, or if the sewage collected in such a trunk sewer must be purified before discharging it into salt water, it will be advantageous for Paterson not to unite with the other cities but to purify its own sewage. The general plan proposed by Mr. Hazen is, settling tanks holding one-half day's flow which can be used as deposition tanks, septic tanks or, if required, as chemical precipitation tanks. A second series of tanks called sludge tanks, of such a size that if the first series of tanks are used as deposition tanks they will hold the sludge from the deposition tanks for one month with the expectation that if this was done, the sludge would undergo septic action, reducing its volume and making it less offensive and easier to handle. Sprinkling filters, similar to those proposed for Cleveland, concrete bottoms with open drainage system. Filling material 10 feet deep of trap rock crushed to go through a screen of  $2\frac{1}{2}$ -inch mesh. Settling tanks to receive the effluent from the sprinkling filters, holding two or three hours' flow. Effluent conduit to carry the effluent into the Passaic River.

LEONARD PARKER KINNICUTT.

**Sludge Treatment in Relation to Sewage Disposal.** J. D. WATSON, Birmingham, England. *Eng. Record*, 54, 246-249.—The paper discusses the aerating and disposing of solids like road grit, coal slack, rags, etc., which in bulk form sludge containing 50 per cent. of water and the deposition of organic sludge containing 90 per cent. water and converting it into an inodorous substance before disposing of it on land or otherwise. The most notable facts in the paper are that a sludge without any objectionable odor can be obtained after septic action extending only through seven weeks, and that the cost of disposal of the sludge can be reduced to about 4 cents per cubic yard of wet sludge. In discussing the question Mr. Watson wishes it clearly understood that in his remarks he is dealing with a sewage having the following characteristics: Daily Average Analysis of Birmingham Crude Sewage for Three Years, 1903-1905 inclusive. Parts per 100,000. Dissolved solids 119.3, suspended solids 74.3, suspended volatile solids 44.9, free and saline ammonia 4.05, albuminoid ammonia 1.57, chlorine 20.2, nitrogen as nitrates and nitrites 0.92, and a low bacterial content about 500,000 per cubic centimeter. The treatment of this sewage at Birmingham for the removal of the suspended matter is in outline as follows: the sewage is passed through oblong tanks, rate of flow, 1.2 feet per minute. The tanks contain two compartments, the first of which serves as a detritus tank arresting the road grit and coarser suspended matter, the second as a septic tank for the deposition of the finer material and for the fermentation of the deposited organic matter. A detritus tank is cleaned out once a week, a septic tank once in seven weeks. In cleaning the detritus tank the supernatant liquid is pumped off, and the slimy part of

the sludge, about 30 per cent. of the total amount, is pumped into channels which feed the septic tanks. That part of the sludge which is too highly charged with sand and grit is sent directly to the sludge trenches, and the still more solid material is lifted out by steam grab and buried at once. The pumping of about 30 per cent. of a sludge of the detritus tank into a septic tank was brought about by the discovery that when the detritus tanks were cleaned out once a week in place of once a month, as had been the custom, the activity of the septic tanks was very much reduced. Mr. Watson accounted for this by the fact that the number of bacteria in the crude sewage was very small, 500,000 per cubic centimeter, that while under the arrangement of cleaning the detritus tank only once a month it allowed time for much putrefaction, and an increase of bacterial life, under the quick method of cleaning the detritus tanks, the incubating ground for the microbes was removed and the bacteria in the septic tanks were deprived of much of the food they formerly received. The experiment was therefore tried of pumping sludge from the detritus tank into the septic tank with the result that the bacterial action was brought up to its usual activity. The cleaning of the septic tanks once per seven weeks was also the result of the study of septic action on Birmingham sewage. With Birmingham sewage after five years of experimentation and dealing with 25,000,000 gallons per day, Mr. Watson found that the liquefaction of the sludge amounted to only 10 per cent. and that the residue or residuum had no objectionable odor. Consequently, the real use of septic tanks is, in his opinion, manufacturing septic sludge, namely, obtaining the residuum of the fermentation process. With Birmingham sewage this residuum, having no objectionable odor, is obtained after a septic tank has been in operation seven weeks. When the tanks are clean, the sludge being without objectionable odor, it is practicable to use the sludge for filling up depressions in the various fields to which it is applied (thus obviating the cutting of trenches, etc.), and thus to reduce the cost from about 6 cents, the cost in 1904, to less than 4 cents per cubic yard of wet sludge.

LEONARD PARKER KINNICUTT.

**Disposal of Waste Water from Cloth Dyeing and Finishing Works at Ravenna, Ohio.** BY HERMAN STABLER. *Ohio Sanitary Bulletin*, 10, 109-132.—The result of experiments made by the U. S. Geological Survey (Division of Hydro-Economics) in coöperation with Ohio State Board of Health. The waste consists of soap and dye liquors. The soap liquor contains in 100,000 gallons, soap 350 pounds, ammoniated compounds 200, pounds, sodium carbonate 30 pounds. The dye liquor contains in 100,000 gallons about 3,000 pounds composed largely of sodium sulphate but containing free acid and various dyes. The ex-

periments gave no very satisfactory results, the author stating that partial purification of various degrees can be obtained by straining through coke, by coke contact filtration, by intermittent continuous filtration through broken stone, and by chemical precipitation. Filtration through sand and chemical precipitation followed by filtration give a high degree of purification. All of the foregoing methods would prove too costly for a separate treatment of factory wastes in the Ravenna case. Recovery of valuable materials from the waste waters is of doubtful economy as an adjunct to purification and is not desirable at Ravenna. Experimentation along the lines of oxidation with subsequent sedimentation or filtration is believed to be the best for future attempts at disposal. LEONARD PARKER KINNICUTT.

**Pollution of the Tidal Waters of New York and Vicinity.**

GEORGE A. SOPER. Discussion, ALLEN HAZEN, X. H. GOODNOUGH, H. W. CLARK. *J. Assoc. Eng. Societies*, 36, 251-272. —The paper gives chemical and bacterial data showing the character of the water in New York Bay and then the results of a careful study of the following subjects: the amount of sewerage entering the bay, the effect of tides, currents and other purifying agencies, the proportion of salt and fresh water, the phenomena of the underrun, the capacity of the water of the harbor to digest sewage and the effect of the pollution on the shell-fish. In the discussion Mr. Hazen takes up the question of the amount of new water that comes into the harbor at each tide, and the consequent amount of dilution of the sewage; X. H. Goodnough, the result of the examination of shell-fish from flats in Boston Harbor; H. W. Clark, the effect of the usual ways of cooking clams and oysters on bacterial life. He states that the results of the experiments made at Lawrence show that when one is eating cooked shell-fish he is not generally eating sterile shell-fish, and that while you can cook them so that the bacteria are killed, simply cooking them until the oysters and clams are considered in just the right condition to eat, does not always kill the bacteria and does not destroy the coli present. LEONARD PARKER KINNICUTT.

**Sewage Pollution of Drinking Water as a Cause of Disease in Animals.** BY VERANCES A. MOORE. *Am. J. Public Hygiene*, 16, 681.—A short statement calling attention to the fact that a verdict of one thousand dollars was awarded in Ayr, Scotland, for damage to cattle caused by drinking from a polluted water supply. The specific damage charged was that the contaminated water produced abortion in the cattle, and also caused a diminution in the quantity of milk secreted. LEONARD PARKER KINNICUTT.

**A Method for the Determination of Hydrogen Peroxide in Milk Together with Some Observations on the Preservation of Milk by This Substance.** BY SAMUEL AMBERG. *J.*



*Biol. Chem.* **1**, 219-227.—The method is based upon the fact that when titanium hydroxide dissolved in sulphuric acid is added to a few centimeters of milk containing hydrogen peroxide, titanium peroxide is formed, which gives to the milk a color varying from a light yellow to a deep orange, according to the amount of hydrogen peroxide present. This reaction may be used for determining approximately the amount of hydrogen peroxide present, by comparing the colors formed with the color obtained by the addition of titanium hydroxide and sulphuric acid to samples of milk containing known amounts of hydrogen peroxide. The samples of milk must be boiled and filtered. Amounts as low as 0.004 per cent. can be determined with a probable error of less than 10 per cent. The quantitative determination fails with human milk, as it is necessary to boil the milk with acids to effect coagulation of the proteids and obtain a clear filtrate. Hydrogen peroxide acts as a preservative but the amount required seems to vary with different milks and under different conditions, but from 0.2 to 0.5 per cent. frequently suffices to keep milk for a few days. LEONARD PARKER KINNICUTT.

## INDUSTRIAL CHEMISTRY.

**The Valuation of Lubricating Oils. Specific Gravity.** *Chem. Eng.* December, 1905.—The usual methods of determining specific gravity, and tables of comparison and formulas for converting Baumé into specific gravity, etc., are given.

The flash test for lubricating oils is described and a cut of the Cleveland flash cup given. The flash tests for various oils should be as follows:

Oils for lubricating.	Flash test not less than °F.
Heavy, slow moving machinery.....	200
Passenger and freight cars.....	200
Engines.....	325
Dynamos.....	325
Air compressors.....	400
Cylinders (low pressure, under 60 pounds).....	450
Gas and gasoline engines.....	450
Cylinders (high pressure, over 60 pounds).....	550

Under the section of cold test the following table is quoted:

	Cold test.	
	°F.	°C.
Russian mineral oil (Baku).....	—20	—29
American mineral oil.....	—10	—23
Rosin oil.....	—4	—20
Castor oil.....	—0.5	—18
Cottonseed oil.....	21	—6
Neatsfoot oil.....	25	—4
Olive oil.....	37	3
Lard oil.....	45	7
Tallow oil.....	79	26

S. P. SADTLER.

**The Valuation of Lubricating Oils. II. Viscosity.** *Chem.*

*Eng.* January, 1906.—The viscosity of an oil is the degree of resistance which its molecules offer to separation from each other. It is proportional to the specific gravity. The temperature has great influence on the viscosity of oils; for example, a sample of Russian oil with a specific viscosity of 99 at 50° F., had only 2 at 200° F. Oil should have as low a degree of viscosity as is consistent with keeping the bearings apart, as greater viscosity causes greater internal friction of the oil, and should, therefore, be proportional to the pressure between the bearing surfaces.

The speed at which machinery is run has an important bearing on the viscosity. The greater the speed, the less the viscosity required. The best means of determining the oil that is best suited for any class of machinery, is by actual trials, and then to determine the viscosity found suitable, and to specify the same. The whole subject of testing of oils for viscosity is so important that the American Society for Testing Materials has appointed a committee to report upon this subject.

Most forms of apparatus used are of the orifice type, in which from 50 to 200 cc. pass through an orifice in a certain time at a given temperature. One form of apparatus, however, is the Doolittle torsion viscosimeter, which measures the resistance offered by the oil to the rotation of a cylinder immersed in it. The simplest form of viscosimeter is one used by the Pennsylvania railroad, which is a glass pipette of 100 cc. capacity with an opening at the bottom of such a size that the 100 cc. of water at 100° F. would flow out in 34 seconds.

The orifice in a pipette can be enlarged by filing, or made smaller by fusion in a Bunsen burner. The Engler viscosimeter is the standard used in Germany, while that of Redwood is standard in England.

The viscosimeter used most in this country is the Saybolt, which is not purchasable, however, in the open market and is used entirely by the Standard Oil Company. Tagliabue has devised a viscosimeter which is practically the counterpart of the Saybolt instrument, but can be used for any temperature. A form of viscosimeter, used by the author, is shown and described as follows: "It consists of an oblong rectangular tin bath, 5 by 8 inches and 6 inches deep. It is provided with an opening ( $1\frac{1}{8}$  inches in diameter) which is closed by a perforated rubber stopper. In the perforation of the stopper, is inserted a short piece of glass tubing, of  $\frac{3}{8}$  inch internal diameter and 2 inches long. A glass tube drawn to a point, as shown, is next fitted tightly into the short tube, by means of a ring of heavy walled rubber tubing. The tube should have about the dimensions shown when it will hold about 75 cc. to the water line. The point of the tube should be ground so that 50 cc. will run through it in about 17 seconds. The bath is provided with a rack, hold-

ing six test-tubes. These latter should be  $1\frac{1}{4}$  inch in diameter when they will hold 75 cc. to the water line."

The Doolittle viscosimeter is described and suggested as the best instrument, although the most expensive.

S. P. SADTLER.

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## AGRICULTURAL CHEMISTRY.

**Canned Meats.** BY THOMAS MACFARLANE. *Laboratory of the Inland Revenue Dept. Ottawa, Canada, Bull. 123.*—The bulletin gives the result of the examination for preservatives of 322 samples of canned meat. The preservatives sought for were salicylic, benzoic, sulphurous and boric acids, but only the last named was detected. Fifty-one of the samples examined contained boric acid amounting to 15.8 per cent. of the entire number of samples. This proportion is less than was found by the same writer in 1903, when 21.2 per cent. of the samples examined were chemically preserved.

W. D. BIGELOW.

**Honey, 1906.** BY THOMAS MACFARLANE. *Laboratory of the Inland Revenue Dept. Ottawa, Canada, Bull. 122.*—Of 54 samples of honey secured in the open market at various provinces of Canada, 44 were found to be genuine, the other 10 being mixed with cane-sugar or glucose.

W. D. BIGELOW.

**The Viscous Fermentation of Milk and Beer.** BY F. C. HARRISON. *Proc. and Trans. of the Royal Society of Canada, [2] 11, 71 (1905).*—The article reviews the literature of the subject from the beginning and gives a detailed description of an extended investigation of 12 species, or varieties of species, of bacillus which produced slimy milk and beer. The results are also given of a careful study of the slime produced by these organisms.

W. D. BIGELOW.

**The Quality of Commercial Cream of Tartar.** BY L. D. HAVENHILL. *Trans. of the Kansas Academy of Science, 1903-1904, 19, 66.*—The analysis is given of a series of samples of cream of tartar obtained in the open market. Of 28 samples obtained from grocers, 13 consisted entirely of substitutes which were sold at a price equaling that asked for good cream of tartar. All of the samples obtained of druggists were pure. The adulterants detected were chiefly calcium acid phosphate and calcium sulphate. Attention is called to the fact that these products are insoluble in 50 parts of hot water, in which quantity cream of tartar is readily dissolved.

W. D. BIGELOW.

**Reports on Food Products.** BY E. W. MAGRUDER. *Bulletins of the Virginia State Dept. of Agr.*—These publications contain the first and second reports of the laboratory mentioned on work



done in connection with the enforcement of the state food law. The law is given in full followed by the regulations that have been adopted for the enforcement of the law. These regulations are, according to the terms of the law, identical with those adopted by the United States Department of Agriculture. Regulations are also given for the labeling of foods and stock feeds. The rest of the bulletins is taken up with a detailed report of the analytical work and a discussion of the same. In all, the analyses of 607 samples of miscellaneous foods are reported and the detailed results are given in tabular form with a convenient summary.

W. D. BIGELOW.

**Inoculation Experiments with Alfalfa and Soy Beans.** BY H. L. RUSSELL AND R. A. MOORE. *22nd Annual Report, Wisconsin Agr. Expt. Sta.*—Field and pot experiments extending over two years showed that inoculation with soil emulsions or with soil scattered broadcast over the plots was more effective than bacterial cultures obtained from two sources. Inoculation of alfalfa with soil from sweet clover fields was successful.

F. P. VEITCH.

**Report of the Chemist.** BY WM. FREAR. *Report Pa. State College, 1904-1905*, p. 17.—A brief summary of the lines of work of the division of agricultural chemistry is given, followed by an appendix containing a plan for a soil test with fertilizers.

F. P. VEITCH.

**Analyses of Fertilizers, Fall and Spring Seasons, 1905-06; Analyses of Cottonseed Meal; Registration of Fertilizers.** BY B. W. KILGORE. *Bull. N. C. Board Agr.*, July, 1906.

**Analyses of Commercial Fertilizers Sold in Maryland.** BY H. B. McDONNELL, ET. AL. *Md. Agr. College Quar.* 33 (1906).—The results of analyses of fertilizers made at the college from February to July, 1906, inclusive are tabulated.

F. P. VEITCH.

**Analyses of Manurial Substances Forwarded for Examination, Etc.** BY C. A. GOESSMANN. *Bull. III, Mass. Agr. Expt. Sta.*—Analyses of miscellaneous fertilizing materials, wastes, and of commercial fertilizers.

F. P. VEITCH.

**Report of the Chemist, Division of Fertilizers and Fertilizer Materials.** BY C. A. GOESSMANN. *18th Ann. Rept. Hatch Expt. Sta., Mass.*—The report includes Part I, a brief report of the official inspection of commercial fertilizers; and Part II, a brief report on general work in the chemical laboratory.

F. P. VEITCH.

**Compilation of Analyses, Fodder Articles, Fertilizer Ingredients.** BY E. B. HOLLAND AND P. H. SMITH. *18th Ann. Rept.*

*Hatch Expt. Sta. Mass.* pp. 218.—A compilation of analyses made at the Massachusetts Stations.

**Compilation of Analyses of Agricultural Chemicals, Refuse Substances, Guanos, Phosphates and Animal Excrements.** BY H. D. HASKINS. *18th Ann. Rept. Hatch Expt. Sta. Mass.* pp. 156.—This is a compilation of all analyses of miscellaneous fertilizing materials made at the Station from 1868 to 1905 embracing material of every conceivable kind. In addition to the maximum, minimum and average figures of the determinations usually made other constituents have been often determined. In many instances special compilations of analyses made since 1897 are given. The analyses are also calculated to pounds per ton of 2,000 pounds.

F. P. VEITCH.

**Compilation of Analyses of Fruits, Garden Crops and Insecticides.** BY H. D. HASKINS. *18th Ann. Rept. Hatch Expt. Sta. Mass.* pp. 184.—The analyses which are confined to the inorganic constituents are tabulated under the following headings: analyses of fruits, analyses of garden crops, relative proportion of phosphoric acid, potassium oxide and nitrogen in fruits and garden crops, and analyses of insecticides. The analyses were all made at the Massachusetts Stations.

F. P. VEITCH.

**Analyses of Commercial Fertilizers.** *Bull. 119, S. C. Agr. Expt. Sta.*—This bulletin contains the analyses of 655 samples of fertilizers collected during the season of 1905-06.

F. P. VEITCH.

**Inspection of Commercial Fertilizers, 1905.** BY F. W. WOLL AND G. A. OLSON. *22nd Annual Report Wisconsin Agr. Expt. Sta.*

F. P. VEITCH.

**Commercial Fertilizers.** BY A. GOSS AND W. J. JONES. *Bull. 112, Purdue Univ. Agr. Expt. Sta.*—This bulletin contains the text of the state fertilizer law, general information in regard to its operation and tabulated analyses of 734 samples collected in 1905. An interesting departure in such bulletins is a fertilizer map showing the consumption of fertilizers throughout the state.

F. P. VEITCH.

**The Chromed Hide Powder Question.** BY FERDINAND KOPECKY, reprinted from *Collegium* in *The Leather Manufacturer*, 17, 53, 79, 94, 115.—The author gives his objections to several methods which have been suggested for the determination of tannin. The only objection mentioned against the method of the A. O. A. C. is the tediousness of preparing the hide powder. The author therefore devises a chromed hide powder of his own made from flesh-splits which are chromed before grinding to powder. The splits should be uniformly chromed through, and

may be shaved and the shavings reduced to powder. In the determination of non-tannins comparisons were made on an oakwood extract between maceration or stirring, shaking and the bell-filter method—the first two adding the powder in two portions and stirring or shaking for different lengths of time. Both stirring and shaking gave considerably higher non-tannins than the bell-filter, and stirring slightly higher than shaking for twenty minutes or longer. After the tannin solution has been in contact with the hide for two hours, longer standing did not materially affect the results, which were practically identical whether the solutions were stirred or shaken. Shaking for only ten minutes gave materially higher non-tannins, but macerating and stirring for fifteen minutes gave results close to those obtained by longer stirring. Repeated filtration of the non-tannin solution lowered the results slightly. Based on these described experiments the author suggests a method that is practically identical with that of the American Leather Chemists' Association (this Review, 12, 221) for extracts. The experiments of Proctor and Parker on the absorption of gallic acid and dextrin by hide are repeated with similar results. In the bell-filter method neutralized chromed powder absorbs more than a slightly acid powder as does also a heavier chromed powder to a certain point, beyond which heavier chroming reduces the absorption. In stirring or shaking, lightly chromed powders show less absorption than heavier chromed powders. Attention is called to the fact that the non-tannin filtrates from heavily chromed powders contain sulphuric acid. Soaking the chromed powder in boiling water gave higher non-tannins than soaking in cold water. It has long been known that the acidity of the mixed tannin and hide powder influences the non-tannin figures, and the author naturally finds that neither sulphuric nor lactic acid is suitable if acidified before shaking, but that acetic acid affects the results least and may be used with satisfaction. The absorption of these acids by hide being great introduces a large error in the analysis of acid or sour liquors, which the author attempts to correct by determining the acidity of the liquor and of the non-tannin filtrate by the lime water method, subtracting the determined acidity from the residues in each case and calculating the tannins from the remainder in the usual manner. Finally certain recommendations embodying the conclusions drawn from the work are made.

F. P. VEITCH.

**Dry-Chromed Hide Powder.** BY H. C. REED. *J. Am. Leather Chem. Assoc.* 1, 193.—This is a discussion of a paper by Ferdinand Kopecky (see preceding abstract) in which the author gives his unsatisfactory experience with the dry chromed powder prepared by Mr. Kopecky, and also gives his conclusions as to the important factors affecting the accuracy of the hide



powder method. Attention is called to the essential identity between the method proposed by Kopecky and the present official method of the American Leather Chemists' Association.

F. P. VEITCH.

**Basicity of Chrome Liquors.** BY FERDINAND KOPECKY. *J. Am. Leather Chem. Assoc.* **1**, 261 (1906).—The ratio of chromic oxide to acid is of the greatest importance to the tanner in using single bath chrome liquors and the analysis of such liquors presents great difficulties. Trial of methods based on precipitation of the chromium with a slight excess of standard alkali and titrating back the filtrate with acid proving inaccurate, the following method was used with satisfaction to the author. A quantity of liquor containing 153 grams of  $\text{Cr}_2\text{O}_3$  is weighed and diluted to 1000 cc. Now add 2 grams magnesium carbonate to 50 cc. of this liquor and boil until  $\text{CO}_2$  is expelled, transfer to a 100 cc. flask and make up to volume and filter through a dry filter. Precipitate the magnesia in 50 cc. of this filtrate as the oxalate or phosphate and weigh as oxide or pyrophosphate. This weight multiplied by 4 equals the  $\text{MgO}$  neutralized by acid in 100 cc. of chrome liquor. From these figures and those obtained by determining the  $\text{Cr}_2\text{O}_3$  the acidity or basicity of the liquor is calculated.

F. P. VEITCH.

**Determination of Color of Tanning Materials.** BY F. P. VEITCH. *J. Am. Leather Chem. Assoc.* **1**, 253 (1906).—The color of different tanning solutions was determined with the tintometer, and color tests were made on skins and on mordanted cotton. The tintometer readings are affected by the manner in which the tannin is extracted from the material, and the readings are not proportional in the inch and half inch cells. No relation could be traced between the tintometer readings and the colors produced on skins, nor could the colors produced on mordanted cotton be correlated with the colors on skins. No two tanning materials behaved the same to different mordants. As yet color tests on skins must be the guide in color work. A method is outlined for this test.

F. P. VEITCH.

**Analysis of Tan Liquors.** BY R. P. CUSHING. *J. Am. Leather Chem. Assoc.* **1**, 228 (1906).—Fresh and spent oak, fresh and spent hemlock, fresh and spent union liquors were used in a study of the following problems. A comparison of a method of dilution suggested last year with the official method, the effect of rate of shaking on the absorption of tannins, effect of time of shaking on absorption, the effect of temperature on dilution. The effect of acids upon absorption of tannins, and the effect of varying the quantity of hide powder. The author concludes that the suggested dilution method is not desirable, the rate of

shaking is not an important factor, if the speed is sufficient to properly agitate the hide and liquor; the reduction of the time of shaking is possible; addition of lactic acid, before shaking out non-tannins, raises the non-tannins somewhat proportionally to the quantity of acid added, but the effect of adding acetic acid is much less marked; and finally that any marked increase in the proportion of hide to tannins will result in an appreciable decrease in non-tannins.

F. P. VEITCH.

**Analysis of Commercial Acids.** BY W. H. TEAS. *J. Am. Leather Chem. Assoc.* **1**, 214.—In the report of the subcommittee of the association the methods tested for the analysis of lactic, acetic, oxalic and formic acids together with the results obtained are given. With the possible exception of volatile acids in lactic acid the results of the collaborating chemists are rather wide, a condition due doubtless, in part at least, to differences in standard reagents. The determination of volatile acids in acetic and formic acids was the least satisfactory of all.

F. P. VEITCH.

**Comparative Analyses with Sprouted Alumina, Chromed and Non-Chromed Hide Powder.** *J. Am. Leather Chem. Assoc.* **1**, 208, from *Collegium*, 1906, 158.—At a meeting held April 22, 1906, the German section of the International Association of Leather Trades Chemists adopted a slightly chromed hide powder containing from 0.4 to 0.5 per cent. of  $\text{Cr}_2\text{O}_3$  as official for that section. This action was based on collaborative work, the average non-tannin figures of which are given in the following table.

	Ordinary hide powder acidified with citric acid.		Chromed hide powder.		
	Per cent.	$\text{Al}_2\text{O}_3$ . Per cent.	Slightly chromed. Per cent.	Strongly chromed. Per cent.	Strongly chromed and partly neutralized. Per cent.
Solid quebracho extract.....	5.4	2.9	4.2	4.1	4.0
Oakwood extract.....	14.2	9.2	11.5	11.5	11.1
Hemlock extract.....	13.8	11.2	12.7	13.2	12.1
Mangrove extract.....	7.9	6.0	7.1	8.5	6.7
Sumac extract.....	20.3	12.6	16.7	16.3	14.6
Mimosa extract, Renner ideal..	6.2	4.5	5.2	5.2	5.1
Mimosa extract, Renner D.....	10.9	7.7	9.3	8.9	8.8
Mimosa extract, regular liquid	10.0	7.2	9.3	9.3	9.0

The conclusions drawn are that the slightly chromed powder gives on the average better comparative values than other preparations tried in the past. It is stated that Dr. Paessler has determined by experiment that grape sugar, cane-sugar and dextrin are not absorbed by chromed hide powder. F. P. VEITCH.

**Lime Spots on Colored Leather.** BY W. EITNER. *Abs. J. Am. Leather Chem. Assoc.* **1**, 249.—The simplest way to remove spots is to soak the softened and washed leather in 2 per cent.

solution of hydrochloric acid for two hours, keeping it agitated and finally thoroughly washing. F. P. VEITCH.

**June Meeting of the British Section of the International Assoc. Leather Trades Chemists.** *J. Am. Leather Chem. Assoc.* **1**, 247.—An abstract of proceedings of the meeting.

F. P. VEITCH.

**The Determination of Soluble Solids.** By H. C. REED. *J. Am. Leather Chem. Assoc.* **1**, 242.—In this report it is shown that the present official method gave more concordant results than the "time contact method," but the writer does not consider the results conclusive. Determination of soluble solids in tanning liquors of a definite barkometer strength, evaporating such quantities of liquors in determining total and soluble solids as will give approximately 0.7 gram of total solids, gives results inferior in every respect to the official method. F. P. VEITCH.

**The Determination of Acid in Tan Liquors.** By A. W. HOPPENSTEDT. *J. Am. Leather Chem. Assoc.* **1**, 221 (1906).—This article is the report of the chairman on the title subject. The present official charcoal, the quinine, the gelatine precipitation, the lime water, the zinc oxide and hide powder, and the magnesia methods were compared on sapped oak and hemlock, and on oak tail-hadler liquors both straight and to each of which a known amount of acetic and lactic acid had been added. With none of the methods were accurate results obtained. The official methods give comparative but low results. The quinine method appears to be the most accurate. The other methods gave erratic results. F. P. VEITCH.

**New Tanning Materials.** By A. A. CLAFLIN. *Shoe and Leather Reporter*, **83**, 8, 68.—Hemlock and chestnut oak bark are rapidly becoming exhausted in the United States and the increasing price of these materials has fostered the preparation of tanning extracts not only from other native materials but from foreign materials as well. The author is of the opinion that the exhaustion of tanning materials is not to be feared as the preparation of extracts from quebracho, mangroves, mimosa, valonia, myrobalans, palmetto and algarobilla will supply the demand for many years. F. P. VEITCH.

**The Chemist in the Tannery.** By H. R. PROCTOR. Reprinted in *Shoe and Leather Reporter*, **83**, 24, 68.—A general discussion of the character and importance of the chemical work required in the modern tannery. F. P. VEITCH.

**Adulteration of American Sole Leather.** *Hide and Leather*, **31**, 21, 25 (1906).—This is a report of the Manchester, Liverpool and District Tanners Federation of Great Britain giving the



results of a chemical analysis of American sole leather as found in England. All of the samples were found to be adulterated to the extent of from 4 to 30 per cent., glucose being found in all samples and Epsom salts in 10. The average for the 18 samples was Epsom salts 2.03 per cent., glucose 7.84 per cent., total weighing matters 10.16 per cent.

F. P. VEITCH.

**Strychnine-Tannate and Its Use in the Analysis of Tanning Materials.** BY S. R. TROTMAN AND J. E. HARTFORD. *J. Chem. Ind.* **24**, 1096; abs. in *The Leather Manufacturer*, **17**, 109 (1906).—Extract the tanning material in the ordinary way or preferably with alcohol in a Soxhlet extractor, using 0.5 gram of the material. Extraction is complete when the alcoholic extract comes through colorless, usually in about one-half hour. Evaporate the extract to about 50 cc., place in a 100 cc. flask and dilute to the mark with water, thus precipitating resins, etc. Filter through a dry Gooch crucible. Place 25 cc. of the filtrate in a 250 cc. flask and dilute with water. Dissolve 0.25 gram of strychnine in about 50 cc. of alcohol, dilute with an equal volume of water, cool, and add to the diluted tannin solution, fill to the mark and shake. Filter through a weighed Gooch crucible. Dry partly in a current of air and complete the drying in a vacuum oven. The figures thus obtained show wide differences, in some instances, from those obtained with hide powder.

F. P. VEITCH.

**An Extractor for Tanning Materials.** BY H. C. REED. *J. Am. Leather Chem. Assoc.* **1**, 176 (1906).

F. P. VEITCH.

**Chromium and Acid in Single Bath Liquors.** BY F. W. ALDEN. *J. Am. Leather Chem. Assoc.* **1**, 174 (1906).—The percentage of chromium and the acid combined with it are the principal constituents to be determined in single bath chrome liquors. The following method for chromium is stated to be rapid and sufficiently accurate. Take a quantity of solution containing from 2 to 3 grams of  $\text{Cr}_2\text{O}_3$  and dilute to 500 cc. Take 10 cc. of this solution, dilute with 15 cc. of water in a 200 cc. flask and oxidize with 2 grams of sodium peroxide, wash down the sides of flask, boil for a few minutes, cool rapidly and add strong hydrochloric acid until the color of the solution becomes dark yellow, indicating the formation of the acid chromate. Add 4 cc. of hydrochloric acid, cool and titrate with N/10 thiosulphate in the presence of potassium iodide in the usual way. Combined acid is determined as follows: Dilute 150 cc. N/2 sodium carbonate to about 150 cc. and bring to a boil. Run in to this slowly 50 cc. of the dilute chrome liquor with constant stirring. Boil, cool, and dilute to 500 cc. Filter and titrate 200 cc. with N/2 hydrochloric acid, multiply by  $5/2$  and subtract from 50 cc. to obtain the amount of alkali apparently neutralized by the chrome

solution. A second determination using this determined quantity of alkali gives sufficiently accurate results. No figures are given.

F. P. VEITCH.

**The Analysis of Commercial Lactic Acid.** BY M. PHILIP. *J. Am. Leather Chem. Assoc.* **1**, 189 (1906).—Lactic acid having become an extensively used deliming and plumping agent its valuation is of importance, for which purpose it is necessary to determine the percentage of actual lactic acid and of such other acids as may be present, usually only sulphuric, but hydrochloric and oxalic acids may be present and these as well as iron should be tested for. As lactic acid contains lactic anhydride in which 2 molecules of lactic acid behave to phenolphthalein as one, it is impracticable to titrate directly with an alkali and the author suggests the following procedure: Dilute 50 cc. of acid to 500 cc. and titrate 50 cc. of this solution with normal alkali, using phenolphthalein as indicator. Now add a measured excess of alkali to the titrated solution and boil for a few seconds and titrate back with normal acid. The total alkali less the acid used in titrating back, multiplied by 1.8 gives the total amount of lactic acid, while from the volume of alkali first required to give the pink color with the indicator the free lactic acid is calculated. Results are only approximate and corrections must be made where greater accuracy is required. If sulphuric or other acids are present they must be determined. No figures showing the accuracy of the method are given.

F. P. VEITCH.

**Teas Percolator Extractor.** BY W. H. TEAS. *J. Amer. Leather Chem. Assoc.* **1**, 181 (1906).

F. P. VEITCH.

**An Investigation of the Barium and Calcium Salts of Gallic, Protocatechuic and Digallic Acids.** BY H. R. PROCTOR AND H. G. BENNET. *The Leather Manufacturer*, **17**, 4, 71 (1906).—The results of experimental work on the method for estimating tannin in tanning material proposed by Parker and Payne (*J. Chem. Ind.* **23**, 648) are given, from which the authors conclude that the method in its original form is altogether unreliable and useless, owing chiefly to the fact that compounds of definite constitution are not produced in the several reactions upon which the method is based, but vary with all variations in methods of work, concentration, temperature, method and order of mixing, etc. Further, the lime-tannin salts are not entirely insoluble and indeed the solubility is likely to be different for each tanning material (see also this Review, **11**, 687).

F. P. VEITCH.

**The Estimation of Ammonia in Used Lime Liquors.** BY H. R. PROCTOR AND D. McCANDLISH. *The Leather Manufacturer*, **7**, 3, 49 (1906).—Fresh lime liquors have practically no unhairing effect, but used liquors owing to the putrefactive bacteria present

have this property. Ammonia and other nitrogen compounds are formed during unhairing and generally speaking the ammonia present is proportional to the age of the liquors. As the ammonia has an unhairing action it affords a standard by which the activity of a liquor may be judged. Direct distillation of ammonia is inadmissible, owing to the formation of ammonia from the other nitrogenous compounds at boiling temperature. It was found this does not take place in liquors heated to  $65^{\circ}$  and a method has been devised in which a current of ammonia- and carbon dioxide-free air is drawn through 50 cc. of lime liquor kept at  $65^{\circ}$ , and the evolved ammonia received in standard acid and titrated. A special apparatus is used and turpentine is used to prevent frothing during the determination. F. P. VEITCH.

**Determination of Nitrogen in Leather.** By J. H. YOCUM. *J. Am. Leather Chem. Assoc.* **1**, 169 (1906).—This is the report of the referee on the determination of nitrogen in leather, and embraces methods which are suggested for the complete analysis of leather. F. P. VEITCH.

**Proceedings of the American Leather Chemists' Association.** *J. Am. Leather Chem. Assoc.* **1**, 2 (1906).—Papers, addresses and discussions. F. P. VEITCH.

**A New and Accurate Method for the Determination of Free Acid in Tan Liquors.** By A. W. HOPPENSTEDT. *J. Am. Leather Chem. Assoc.* **1**, 192 (1906).—The method which the author designates the "quinine method" is as follows: Dilute 50 cc. of the tan liquors to 500 cc. and to 200 cc. of the dilute liquor add 20 cc. of quinine solution (made by dissolving 15 grams pure quinine in 110 cc. of 95 per cent. alcohol previously neutralized and diluting to 200 cc. with water), shake and filter. Titrate 100 cc. of filtrate with N/10 alkali, using phenolphthalein, and multiply the number of cubic centimeters used by 0.066 to obtain acidity as acetic acid in original liquor. The quinine forms insoluble salts with tannin and soluble salts with the free acids. These soluble salts are acid to phenolphthalein and may be titrated as if they were free acids. F. P. VEITCH.

**Chroming of Hide Powder.** By C. W. NORRIS. *J. Am. Leather Chem. Assoc.* **1**, 203 (1906).—In addition to the officially chromed hide powder a dry chromed hide prepared according to Kopecky, and hide powders chromed with different quantities of the following liquors were used: Liquor No. 1, 100 grams chrome alum + 6 grams dry sodium carbonate; liquor No. 2, 100 grams chrome alum + 10 grams dry sodium carbonate; liquor No. 3, 100 grams chrome alum + 14 grams dry sodium carbonate, each liquor diluted to 1 liter and used in such quantity that from each, hides containing 5 per cent., 10 per cent. and 20 per cent. of



chrome alum were prepared. The average non-tannin results follow.

	Quebracho extract. Per cent.	Hemlock extract. Per cent.	Chestnut oak extract. Per cent.
Official hide .....	15.0	23.6	19.6
Kopecky hide .....	14.4	22.9	19.9
Chromed with Solution No. 1, 5 per cent.....	15.4	23.6	19.4
“ “ “ No. 1, 10 “ “ .....	14.5	23.2	19.2
“ “ “ No. 1, 20 “ “ .....	14.9	23.4	19.6
“ “ “ No. 2, 5 “ “ .....	15.4	23.5	19.4
“ “ “ No. 2, 10 “ “ .....	14.6	22.8	19.2
“ “ “ No. 2, 20 “ “ .....	14.9	22.9	19.4
“ “ “ No. 3, 5 “ “ .....	15.3	23.6	19.3
“ “ “ No. 3, 10 “ “ .....	14.7	23.3	19.0
“ “ “ No. 3, 20 “ “ .....	15.0	20.1	19.4

The opinion is expressed that a fully chromed hide powder will not deteriorate on long standing. F. P. VEITCH.

**Paper Mill Effluents.** *Paper Trade J.* 43, No. 2, 60 (1906).—Vogel and also Krause have studied the composition and effect of mill effluents. Vogel finds that mill effluents contain on an average 0.25 gram per liter organic matter; in the soda process 90 per cent. of the waste may be destroyed or recovered.

F. P. VEITCH.

**Studies in Plant Mutation.** BY HENRY B. SLADE. *Am. J. Pharm.* 78, 311 (1906).—This article, left among the posthumous papers of Prof. H. B. Slade, is an unfinished study of the action of various plant alkaloids upon enzymic activity. A series of tests with 31 different species of plants (representing 24 genera and 20 families) show that the action of such alkaloids with diastase varies according to the nature of the alkaloid and the family of plants. By comparing the various tests it is also shown that as a general rule the alkaloids of any particular family of plants assist the diastatic activities of the members of this family, while alkaloids of distant families retard the diastatic action. Veratrine, for example, the characteristic alkaloid of the *Liliaceae*, increased the diastatic power of the flowers of *Brodiaea*, which belongs to this family, 10 times, but decreased the diastatic action of *Sisymbrium* among the *Cruciferae* and of *Eschscholtzia* among the *Papaveraceae* over one-half. The same selective action of the various alkaloids upon the speed of the germination of seeds from different families of plants was also noted. Several species were tested as to the action of alkaloids upon oxidizing enzymes, and it was found in general that alkaloids which favored diastatic action hindered the oxidase, while principles injuring the diastatic action, as anemonol, aided the oxidase. C. A. BROWNE, JR.

**Forage Plants of Wyoming and Their Chemical Composition.** BY H. G. KNIGHT, F. P. HEPNER AND A. NELSON. *Bull.* 170 *Wyoming Expt. Sta.*—The authors believe that results of ex-

aminations of forage crops, made by other stations are not applicable to the conditions of higher altitudes of Wyoming, except to a limited extent. It has been shown that the chemical composition and digestibility of alfalfa when grown at high altitudes, under arid conditions, varies greatly from alfalfa grown at low altitudes under humid conditions, which is an important factor in making up feeding rations. Forage plants grown under the peculiar conditions existing in Wyoming, show a high percentage of crude fiber and crude protein, and a low percentage of fat.

W. W. SKINNER.

**Insecticides.** BY H. A. SURFACE. *Division of Zoology, Vol. IV. No. 1. Penn. Dept. Agr.*—Formulae for, and methods of, using the various insecticides, are given. W. W. SKINNER.

**The Composition of Soy Beans.** BY WILLIAM FREAR. *Rept. Penn. State Coll. Agr. Expt. Sta.* 1905, p. 39.—Four varieties of soy beans, grown on rather poor soil, "Hagerstown clay," yielded from 15 to 25 bushels per acre, the following table showing the physical and chemical characteristics.

	Cross-bred, No. 6.	Early black.	Italian san.	Early green.
Color.....	brown	black	clay yellow	pea green
Average long diameter (inches)	0.21	0.22	0.17	0.19
Weight per 100 seeds.....	15.93	28.65	15.86	22.93
Weight per bushel (pounds)....	60.9	59.7	61.5	59.3
Water (air-dry) .....	11.42	7.09	6.86	7.33
Ash .....	4.48	5.10	5.14	5.49
Protein.....	35.94	33.56	35.44	33.44
Fiber.....	4.64	4.98	5.11	5.61
Nitrogen-free extract.....	26.11	29.46	29.60	28.43
Fat.....	17.41	19.81	17.85	19.70

J. A. LECLERC.

**Market Milk: Its Production and Composition.** BY J. B. LINDSAY. *Rept. Hatch. Expt. Sta. Mass.* 1906, p. 74.—A study of the dairies supplying milk in the territory round about Amherst and Northampton has revealed the fact that the sanitary conditions are very unsatisfactory, the majority of the milk-men being ignorant of the principles of modern dairying. The chemical examination showed the milk to be above the Massachusetts standard in composition. The microscopical examination showed it to be more prolific in bacteria than necessary, thus supporting the statement that the sanitary conditions were bad.

J. A. LECLERC.

**Concerning Wheat-bran.** BY J. B. LINDSAY, E. B. HOLLAND, P. H. SMITH AND J. G. COOK. *Rept. Hatch. Expt. Sta.* 1905, p. 94.—This is a study of the cost of the digestible protein and total digestible matter in wheat bran, as well as the use of bran in the farm economy. It also contains results of the cost of the

fertilizing ingredients in bran as compared with other concentrates. A table giving the composition of wheat bran along side of cottonseed meal, gluten feed, distiller's dried grains and malt sprouts, shows that the bran contains considerably less protein, though somewhat more nitrogen-free extract than the other feeds. The cost per pound of digestible matter in bran is about the same as that of cottonseed meal and of distiller's grains, though more than that of the corn by-products. The cost of digestible protein in wheat bran is more than in the other concentrates above mentioned. Assuming the value of nitrogen per pound to be 18½ cents, potash 4¼ cents, and phosphoric acid 4 cents, bran is shown to contain less value in fertilizing ingredients than the other feeds.

J. A. LECLERC.

**Eureka Silage Corn.** BY J. B. LINDSAY AND P. H. SMITH. *Rept. Hatch. Expt. Sta. Mass.* 1906, p. 86.—A two years' experiment, in order to study the comparative composition, digestibility, and economic value of Eureka silage maize, a southern and medium dent corn, such as matures well in this latitude, showed the following composition of green corn:

	Eureka.		Pride of the North.
	1903.	1904.	1904.
H <sub>2</sub> O.....	82.60	83.60	77.50
Ash.....	1.08	1.08	1.05
Protein.....	1.63	1.48	1.85
Fiber.....	4.77	5.48	4.97
Nitrogen-free extract.....	9.65	8.11	14.06
Fat. ....	0.27	0.25	0.57

On the dry basis the differences in composition are more apparent, the Eureka containing decidedly more ash and fiber, somewhat more protein, and much less extract matter than the Pride of the North. The composition of the stover from the two varieties is quite similar. The field-cured material differed notably in the percentage of water.

	Eureka.		Pride of the North.	
	Whole plant.	Stover.	Whole plant.	Stover.
Water.....	68.92	62.89	37.84	18.13

These figures show that Pride of the North has about twice the feeding value of Eureka per ton. A table giving the comparative composition of the leaves, stalks, ears, and husks of the two varieties shows that the leaves are similar in composition; the stalk of Eureka contains more fiber; the ears of this variety contain more protein, ash, considerably more fiber, less fat and extract matter than the ears of Pride of the North. The composition of the husks was quite uniform. Another table giving the relative yield of different parts of the plant, show that Eureka produces only 7.25 per cent. of ears while Pride of the North produces 22.11 per cent. The former produces 63.6 per cent. stalks, the latter 46.8 per cent. The amounts of leaves and husks do not differ much in the two varieties. Eureka yielded 20 tons



of green fodder per acre, and Pride of the North 13 tons, but the latter contained nearly as much dry and digestible food material as the former, the excess yield of Eureka being water.

J. A. LÉCLERC.

**Nature and Composition of Bibby's Dairy Cake.** BY J. B. LINDSAY, E. B. HOLLAND, P. H. SMITH AND J. G. COOK. *Rept. Hatch. Expt. Sta. Mass.* 1906, p. 79.—This dairy cake, which is made of ground cottonseed, locust or carob bean, maize, wheat and other cereals or their by-products, besides fenugreek and salt has the following composition and coefficient of digestion.

	Per cent.	Dry matter.
H <sub>2</sub> O.....	11.96	70
Ash.....	7.89	33
Protein.....	17.99	66
Fiber.....	7.91	31
Extract matter.....	45.05	81
Fat.....	9.20	92

The high percentage of ash is due to the addition of salt. In composition and digestibility, it resembles closely standard wheat middlings; its cost is, however, somewhat greater, 2.43 and 2.11 cents per pound of digestible matter respectively.

J. A. LÉCLERC.

**Association of Official Agricultural Chemists. 22nd Annual Convention.** *U. S. Dept. Agr., Bulletin 99. Determination of Albuminoid Nitrogen in Cereals.* BY J. A. LÉCLERC AND W. C. LOUNSBURY.—The authors call attention to the fact that in the methods of the Association the previous extraction with acetic acid of material to be examined by means of the Stutzer method has been omitted, and that consequently considerable difficulty is often encountered in the examination of substances rich in alkali phosphates. They also show that considerable error may at times be occasioned by the use of alum as directed by the official method, and that this error varies with the amount of alum so used.

W. D. BIGELOW.

**Report on Fats and Oils.** BY L. M. TOLMAN.—The titer test was studied by the writer, and a few minor changes in the method previously studied by the Association were recommended. Especial attention was given to the method of drying the fatty acids, that forming the chief difference of opinion at the time of the initiation of the work. Several methods commonly used for making the determination are described by the writer, and attention is called to the necessity of specifying as exactly as possible the conditions of making the examination. Collaborative work on the Belfield test for the detection of beef stearin in lard indicates that when a satisfactory method is employed there is no difficulty in detecting additions of beef stearin to lard. The ad-

dition of 10 per cent. of lard stearin to one sample did not interfere with the method.

W. D. BIGELOW.

*Fruit Products.* BY F. MONROE BAILEY.—Work on this subject was confined to that of the writer and was devoted chiefly to the methods for the determination of water in various dried fruits. The writer concludes that results obtained by drying fruit products, with the addition of a porous material, in a steam-oven at 100° are comparable with results obtained by drying with sand at the same temperature. "Drying with sand gives slightly higher and presumably more accurate results, but the increased accuracy does not seem to warrant the expenditure of the extra labor and time involved in the process." Although the material appears to "lose weight indefinitely, it seems reasonable to discontinue the heating when the increment in the amount of water obtained for an eight-hour period becomes approximately three-fourths of 1 per cent." The writer directs that 10 grams of the finely comminuted material be weighed into a flat-bottomed aluminum dish, 8 cm. in diameter, and dried thirty hours at 100°. The material is then cooled in a desiccator for at least an hour and weighed.

W. D. BIGELOW.

*Cacao Starch.* BY BURTON J. HOWARD.—The writer referred to a publication by Kraemer in which "the author called attention to the alteration in the compound starch grains of the seeds of *Theobroma cacao* on the application of heat, producing masses resembling the natural starch grains of corn, wheat, barley, rye and potato in size and shape and showing in some cases even a concentric or eccentric lamellated structure." The writer attempted to confirm this statement and failed completely. He calls attention to the improbability of "cacao starch being transformed by swelling to resemble in size and form any of the larger kinds and yet retain even their original activity towards polarized light, to say nothing of having that activity changed in its leading characteristics; that is, from a compound to a simple cross and at the same time intensified in degree of activity." He also calls attention to the fact that the number of starch grains in an individual cell, rarely, if ever, exceeds 18 or 20, and that all of these if united in one mass would not equal in size an average grain of wheat or potato starch. Considering these facts, he is forced to the conclusion that if the contention of Kraemer is correct they indicate that a migration of starch grains must occur *in toto* from one cell to another, and that through the solid cell wall without rupturing the same. "Even if such an inconceivable change took place, it is still impossible to conceive, with our present knowledge of starches, that we should find in such aggregations the necessary characteristics of polariscopic activity as are present in the larger types of starches."

W. D. BIGELOW.

*Analysis of Prepared Mustard.* By A. I. WINTON.—Detailed methods for the examination of prepared mustard were submitted by the writer and accepted by the Association. The detailed results of the examination of 72 samples of prepared mustard are also given in tabular form. W. D. BIGELOW.

*Report on Adulteration of Dairy Products.* By A. E. LEACH.—The detection of watered milk with special reference to the method of determining the same by means of the refractometric examination of the serum was discussed. The results of the examination of a large number of samples are given, and detailed methods for the use of the refractometer in determining added water. W. D. BIGELOW.

*Report on Tea and Coffee.* By HERMANN C. LYTHGOE.—Additional work by the writer confirms the methods for the examination of tea and coffee adopted by the Association at its previous meeting. The writer regards the determination of petroleum ether extract, crude fiber, reducing sugars, starch, and caffeine as usually sufficient for the quantitative analysis when made supplementary to the microscopic examination. W. D. BIGELOW.

*Report on Distilled Liquors.* By C. A. CRAMPTON.—The results are given of the examination of 4 samples of whisky of the following description:

No. 1. Genuine whisky, four years old, aged in wood.

No. 2. Factitious sample, made by mixing several trade whiskies.

No. 3. Same as No. 2, but with 10 per cent of pure methyl alcohol added.

No. 4. Artificial whisky made up in the laboratory of the Internal Revenue entirely from neutral spirits by addition of caramel and flavoring extracts and with 0.25 per cent. of pure amyl alcohol added.

Results on these samples were obtained from ten laboratories. All analysts distinguished without difficulty the various kinds of whisky, and all were able to detect methyl alcohol in the sample to which it had been added. The qualitative tests of Trillat and of Riche and Bardy, and the quantitative method of Leach by means of the immersion refractometer, were all successfully applied to this sample.

"The Marsh test for the presence of artificial coloring, using amyl alcohol as a selective solvent for the natural coloring-matter derived from wood, was found to give satisfactory results and will doubtless be a valuable addition to the tests already in use. It is used to a considerable extent as a field test by internal revenue officers."

The work demonstrated that fusel oil can not be satisfactorily determined by the Roesse method. On the other hand, results



obtained by the Allen-Marquardt method appear to be satisfactory.

W. D. BIGELOW.

*The Study of Cider and Vinegar.* BY L. M. TOLMAN AND J. A. LECLERC.—Three papers were presented devoted to the determination of solids in cider and vinegar, the lead precipitate test, and the study of second pressing cider. It was found that the results obtained by the determination of solids in cider and vinegar in the vacuum oven agreed more closely with those obtained by drying for two hours on the steam-bath than by any other method.

It was found that the precipitate caused by the addition of lead acetate to cider vinegar was due chiefly to the formation of a precipitate of lead phosphate, and is not an indication of the presence of malic acid as has been commonly stated.

The writers suggest that the addition to apple cider of second pressing cider may be readily detected, owing to its difference in composition. The non-sugar solids of second pressing ciders were found to be much higher than is the case in ordinary apple cider, and to contain a considerably larger quantity of material precipitated by alcohol, which was found to contain approximately 46 per cent. of galactans and 33 per cent. of pentosans.

W. D. BIGELOW.

*Methods for the Detection of Food Preservatives.* BY W. D. BIGELOW.

*Effect of Canning on Preservatives.*—The claim having been repeatedly made that certain chemical preservatives were formed in the canning of foods, owing to the heat of the process retort, the writer prepared a number of samples of various articles of food and canned them in the laboratory. It was found that in no case where preservative had not been employed was any reaction obtained which could possibly be interpreted as indicating the presence of the same. A considerable amount of the formaldehyde appeared to disappear as a result of the operation of canning.

*Detection of Formaldehyde.*—The method of Arnold and Mentzel,<sup>1</sup> using ferric salts, appears to be applicable to the detection of formaldehyde in solutions of from 1 part in 40,000 to 1 part in 50,000. The reaction is apparently characteristic for formaldehyde.

The method by the same authors,<sup>2</sup> using phenylhydrazine hydrochloride and sodium nitroprusside, appears to be somewhat more delicate than the preceding and to be a characteristic reaction for formaldehyde even in the presence of appreciable amounts of other aldehydes.

<sup>1</sup> Z. Nahr. Genussm. 5, 353 1902.

<sup>2</sup> Chem. Ztg. 26, 246 (1902); Abs. J. Chem. Soc. 82 [2], 367 (1902); Abs. Chem. Centr. 1902, Pt. 1, p. 1077.

Rimini's method<sup>1</sup> was also found to be satisfactory for formaldehyde and to be sensitive to that substance in dilutions of from 1 part in 40,000 to 1 part in 50,000

*Detection of Benzoic Acid.*—The results of a careful study by Mr. Chas. S. Ash of Peter's method for the detection of benzoic acid are also included.

W. D. BIGELOW.

*Report on Sugar.* By L. S. MUNSON.—The writer reported a continuation of the lines of investigation carried on during previous years with the idea of establishing a uniform method of manipulation for the determination of the various reducing sugars. A modification of the Soxhlet-Fehling reagent was found to be the most satisfactory for the gravimetric determination of reducing sugars, this solution exerting less action upon sucrose than that of Allihn or Meissl. The reduced copper in the experiments was determined by direct weighing of the cuprous oxide, using, as a check, an adaptation of Low's volumetric method.

C. A. BROWNE, JR.

*Special Analytical Methods of Sugar Analysis.* By C. A. BROWNE, JR.—The writer gave results upon methods for analyzing mixtures of reducing sugars and mixtures containing *d*-glucose,  $\delta$ -*l*-fructose and sucrose, a full report of which has been published in this Journal (28, 439 (1906)). A study of the influence of temperature upon the polarization of raw cane-sugars showed that low-grade products, owing to the presence of  $\delta$ -*l*-fructose, polarize considerably more at higher temperatures, instead of lower as is the case with refined sugars, so that the formulae and tables for correcting the polarization of sucrose to a constant temperature are of no value with products of this class.

C. A. BROWNE, JR.

*Report on Molasses Analysis.* By H. E. SAWYER.—Attention is called to the numerous errors which result in attempting to polarize concentrated solutions of molasses, and arguments are given to show that polarizations should be made in solutions of  $\frac{1}{2}$  or  $\frac{1}{5}$  the normal concentration. The paper is in large part a summary of previous reports (*U. S. Dept. Agr., Bur. Chem., Bull. 81*, p. 175, this Journal, 27, 691 (1905)).

C. A. BROWNE, JR.

*Report on Saccharine Products (Maple Sugar and Syrup).* By J. HORTVET.—The writer gives the coöperative results of 7 chemists upon the determination of the lead subacetate precipitate, ash constants, and malic acid value on two samples of maple syrup and two samples of maple sugar. The significance of the results in testing for adulteration of maple products is shown by the comparative analyses of 4 brown sugars.

C. A. BROWNE, JR.

<sup>1</sup> Ann. farmacol. 1898, p. 97; Abs. Chem. Centr. 1898, Pt. I, p. 1152; Abs. J. Chem. Ind. 17, 697 (1898).

*Report on Dairy Products.* BY G. E. PATRICK.—In reporting upon the work of three coöperating laboratories regarding the effects of preservatives upon the determination of milk proteids, the writer concluded that neither chloroform, carbon bisulphide, benzene, potassium bichromate, potassium fluoride nor mercuric chloride is able to keep the proteid constituents of milk for any great length of time in condition for accurate determination. In the work upon methods for detecting renovated butter, the melting and foam tests, microscopic appearance and modified Waterhouse test were studied, four laboratories taking part in the coöperative work. In making the melting test the referee preferred the temperature of a boiling water oven to the usual method of melting at 60–70°. As regards the foam test, it was concluded that a better judgment could be formed, especially in doubtful cases, by the use of both the tube and spoon methods than by either alone. As to the microscopic examination of casein spots it was stated that renovated and genuine butters could be sharply differentiated by this means but that pasteurized butters failed to show any characteristic differences. The results obtained by the Waterhouse test showed that little dependence could be placed upon observing the character of the sample after melting, since oiliness and non-oiliness depend to a large extent upon the speed of stirring. C. A. BROWNE, JR.

*Milk Analysis by Calculation.* BY G. A. OLSON.—For calculating the percentage of protein in milks the writer found the formula of Richmond inaccurate and used instead the equation,  $P = 0.368 T + 0.33A - 0.383F$ , where  $P$ =proteids,  $T$ =total solids,  $A$ =ash, and  $F$ =fat. Tables were given showing the adaptability of this formula to numerous analyses of milk.

C. A. BROWNE, JR.

*The Deterioration of Bleaching-Powder.* BY B. H. SMITH.—A study of the chemical changes which occur in bleaching-powder, and the effect upon the rate of deterioration of different forms of containers.

W. W. SKINNER.

*Report on Insecticides, Fungicides and Disinfectants.* BY B. H. SMITH.—A report and discussion of coöperative work upon insecticides, etc. Numerous analyses are given of Paris green, London purple, tobacco extract, sulphur dip, formaldehyde, chloride of lime and phenolic disinfectant. W. W. SKINNER.

*A Study of the Lime, Sulphur, Salt, Soda Wash.* BY J. K. HAYWOOD.—An examination of the sulphur compounds in the wash when made according to the formula given; also the results of the decomposition of the wash after spraying and subjection to weathering. It was found that thiosulphates, sulphides and polysulphides, sulphites and sulphates existed in the original solution. After spraying, the thiosulphate gradually disap-



peared, and if carried to finality, only free sulphur and sulphates would exist.

W. W. SKINNER.

## PATENTS.

MARCH 27, 1906.

816,532. Edward Covington, Salt Lake City, Utah. **Fire-proof and water-proof composition.** The composition is made up of burnt gypsum 25, mica 50, silica 15, graphite 10, and mica schist 5 per cent. Proportions may be varied for different purposes.

816,547. Robert Gross, Rastenburg, Thuringia, Germany. Assignor to the Firm of Ferro-Phosphat-Gesellschaft, Emilio Schramm & Co., Hamburg, Germany. **Making medicines.** White phosphorus is burned and the products collected and distilled; the distillates are separated, and one of them is heated and stirred and to it is added ferrum reductum. The patentee claims his product differs from phosphorus tetroxide as commonly known. The final mixture is said to be an aromatic resinous substance.

APRIL 3, 1906.

816,622. Achille Van Steenkiste, Brussels, Belgium. **Retting textile fibers.** The fibers are first put in a bath of 95° to 100°, the hot water converts the pectin into parapectic acid, a second bath follows at a pressure of three atmospheres, which dissolves and discharges the parapectic acid, and the fibers may be softened by glycerol or sodium sulphuricinate.

816,648. Robert W. Cornelison, Bloomfield, N. J. **Paint.** Starch 24, gum tragacanth 3, dissolved in 70 parts of water; glycerol  $\frac{1}{2}$ ,  $\beta$ -naphthol  $\frac{1}{6}$  part, together with a water-soluble color as an aniline dye. Propyl alcohol 12 parts may be added.

816,707-8. Jacob Bredel, Höchst-on-Main, Germany. **Quartz glass** from quartz sand, and articles therefrom. The raw material is melted in a cohesive mass, then cooled, broken up in small pieces which are heated several times to a high temperature and quickly cooled in water, whereby air bubbles are prevented, and a glass unaffected by changes of temperature obtained. The second is for making the material in a fibrous or woolly state, molding the mass and again fusing it.

816,751. Harry E. Smith, London, England. **Photographic reducing agent.** A cobalt compound, with the nitrite radical group, a metal of the alkali group, and an acid, followed by an ammonia bath. "Erdmann's salt,"  $\text{Co}_2(\text{NH}_3)_4(\text{NO}_2)_3\text{K}_2$ , 0.3 gram to 50 cc. of warm water, to which an equal volume of 15 per cent. dilute sulphuric acid is added, is the reducing solution. Finish with a bath of dilute ammonia. A list of similar salts is given, that may be used.

816,764. Wm. Valentine and Anson G. Betts, Troy, N. Y. **Smelting lead ores.** Lead sulphide ores are fused into a matte and a slag, the lead is separated from the matte electrolytically by bringing it in contact with a cathode in a fused electrolyte of sodium chloride containing sodium sulphide and in which lead sulphide is insoluble.

816,772-3. To same inventor as above. The first for making **lead and sulphur dioxide** from lead sulphide by the reaction of metallic iron and sodium, the lead is removed from the melted matte which is oxidized by an air blast. The second is for a similar process, the slag being limited to 2 per cent. of ferrous oxide on the first melt but by repeating it, this percentage of iron is diminished.

816,830. Milton S. Talbot, Durban, Natal, by Albert A. Shuter, administrator. **Explosive.** Potassium chlorate 56, camphor, castor oil and manganese dioxide 4 each, burnt umber 8 and potassium bichromate 12 parts.

816,833. Joseph G. Weyer, Providence, R. I. **Molding material for metal casting.** Plaster of Paris and sifted coal ashes equal parts.

816,850. George H. Earp-Thomas, Wellington, New Zealand. **Nitrogen-fixing bacteria.** The nodules of a leguminous plant are cleansed and sterilized, the nodules crushed to obtain the nitrogen bacteria and increasing their number by successive cultures and subdivisions of the colonies till suitable quantities are obtained in tubes that are finally sealed for distribution to farmers. The culture medium is free from nitrogen and is composed of ash 14, shredded agar 26, maltose 35, and water 2210 parts by weight. A restoring medium consists of ash 10, maltose 26 and water 1500 grams.

816,918. Rudolf Knietsch, Ludwigshafen-on-Rhine, Germany. Assignor to General Chemical Co., New York, N. Y. **Sulphuric acid.** Sulphuric anhydride and a diluent are both supplied simultaneously to acid of the same strength it is desired to obtain, so that the liquid remains of the same degree of concentration from beginning to end of the operation.

816,925. Otto Liebknecht, Frankfort-on-Main, Germany. Assignor to Roessler and Hasslacher, New York, N. Y. **Magnesium perborate.** A white amorphous precipitate which, on being treated with water, dissolves out acid magnesium perborate while a basic perborate goes into solution obtained by the reaction of boric acid on a mixture of magnesium sulphate and sodium peroxide.

816,928. John A. Lyons and Edward C. Broadwell, Chicago, Ill. **Ammonia.** An alkaline borate is electrolyzed and the borate reduced to boron at the anode, which is separated from the

cathode by a jacket of resistant material, nitrogen is introduced between the anode and jacket, and steam brought in contact with the nitride thus produced, causing the boron to become boric anhydride.

817,010. Victor H. Schutze, Riga, Russia. **Crystallizing sugar.** A hot saturated solution is caused to slowly travel under the influence of a vacuum through an elliptical vessel which is slowly rocked, and simultaneously causing a cooling liquid to travel in a helical path around the outside of said vessel in the opposite direction to the flow of said solution.

817,126. Leon P. Lowe, San Francisco, Cal. **Illuminating gas.** Two regenerating stoves are used, hydrocarbons being passed through one and steam admitted to unite with the condensable portion, thereby making carbon monoxide and hydrogen, and the mixture is passed through the second stove in the same direction as the heating gas thereof.

817,141. Carleton Ellis, New York, N. Y. Assignor to Chadeloid Chemical Co., same place. **Non-inflammable paint remover.** Wax 2, carbon tetrachloride 15, ethyl alcohol 10 and amyl acetate 1 part.

Reissue 12,470. Richard Liebold, Weimar, Germany. **Acid-proof cement.** Burnt unground cement 100, Japan wax 300, caustic potash 20, and water 8,000 parts, the mixture being then ground.

APRIL 10, 1906.

817,158. Heinrich Colloseus, Berlin, Germany. Process of **making a trass from blast-furnace slag.** Milk of lime is injected into and incorporated with the stream of molten slag in such quantity as to be immediately evaporated.

817,159. Max Conrad, Aschaffenburg, Germany. **Dialkyl-barbituric acid.** Dialkylcyanacetylurea is heated with a mineral acid until dialkylmalonuramic amide is formed and on continuing the heat dialkylbarbituric acid will be formed.

817,162. Thomas A. Edison, Llewellyn Park, N. J. **Alkaline storage batteries.** The negative mass contains finely divided iron and metallic mercury, a reversing current is sent through the cell to completely oxidize the negative mass and prevent atmospheric oxidation during shipment.

817,164. Thaddeus Emilewicz, Berlin, Germany. Assignor to Chemische Fabrik auf Actien, vorm. E. Schering, same place. **Benzoylalkylaminoethanols.** As free bases these compounds are insoluble in water, and decompose on boiling with alkalies into benzoic acid and the corresponding amino alcohol, they combine with acids to form salts that are anesthetics and have



the formula  $C_6H_5CO.O.CH_2.CH_2N \begin{matrix} \nearrow R_x \\ \searrow R_y \end{matrix}$ ,  $R_x$  standing for alkyl and  $R_y$  for hydrogen that may be replaced by an alkyl.

817,166. Joseph W. England, Philadelphia, Pa. Assignor to Smith, Kline and French Co., same place. **Disinfecting compound.** A lithiomericuric iodide, forming deliquescent lemon-yellow crystals, and soluble without decomposition in water, alcohol and ether.

817,194. Adelheid Schulz, New York, N. Y. **Insecticide.** Borax and talcum one part each, and ammonium sesquicarbonate two parts.

817,267. August E. Nienstadt, Newark, N. J. Assignor to George W. Kuchler, New Rochelle, N. Y. **Bleach compound.** Sodium peroxide 1 part and dry sodium carbonate 4 parts.

817,280. Jacob S. Smith, Chicago, Ill. **Making illuminating gas.** Crude petroleum is mixed with an excess of steam, the mixture being projected into a hot chamber to fix the gases, the entire products being in a swiftly moving contracted current led out of said chamber, and the hydrocarbons not gasified being deposited by gravity in a suitable vessel, as a liquid, the temperature of the chamber being controlled by the supply of steam, and the generation of gas being continuous.

817,414. Horace F. Brown, Chicago, Ill. **Reducing ores.** The finely powdered ore is suspended in a current of reducing gas moving in the same direction, and forcing the particles together and oxidizing them on a molten slag-covered bath, and mixing the reducing gas over the surface of the bath to increase its heat, whereby the metal separates by gravity from the slag while the latter protects it from the oxidizing atmosphere.

817,419. Otto Dieffenbach, Darmstadt, Germany. **Making metal tubes by electrolysis.** Commminuted kieselguhr is mixed with the electrolyte, the current passed and the cathode agitated to dislodge hydrogen and smooth the metallic deposit by the action of the kieselguhr.

817,569. Herbert E. Ives, Woodcliffe-on-Hudson. **Diffraction color photograph.** Three diffraction gratings differently ruled, and a line screen with opaque spaces twice as wide as the clear spaces, are arranged so that rays from three successive images, each representing one of the primary color sensations, are projected through them on the sensitive plate, while the line screen is shifted between each exposure the width of one space.

817,608. Edward G. Adames, Caledonian Road, County of Middlesex, England. **Decorating wood.** The wood is first polished with a mixture of shellac 70, mastic 5, and colophony 2 parts, then the surface is rubbed with a mixture of beeswax 16,

Canada balsam 5, and Russian tallow 2 parts, then tinfoil is laid on and cut out in any design, the scrap removed and the exposed composition washed off, the exposed surface painted or otherwise decorated, and the tinfoil removed and the remaining composition washed off.

817,690. Henry S. Blackmore, Mt. Vernon, N. Y. Making **carbon acids and ketones**. A hydrocarbon is caused to unite with carbon dioxide by passing through a fine wire diaphragm at a regulated temperature.

817,732-3-4. Werner von Bolton, Charlottenburg, Germany. Assignor to Siemens and Halske. Pure metallic **tantalum** is made and used for incandescent filaments and glowers.

APRIL 17, 1906.

817,743. Robert Bell, London, England. **Treating ship bottoms, etc.** To protect surfaces from fouling or to render them antiseptic they are coated with a layer of paint or varnish and sulphur is forced into the layer by compressed air so as to form thereon a protecting crust.

817,899. Joseph B. Bessey, London, England. **Producing fuel from peat**. Peat which has been previously freed from water by mechanical means is exposed to the effect of the alternating electric current of 200 volts and 1200 amperes per ton of the solid material contained in the peat, the current being regulated so that a heating of the peat above 100° is avoided, and the water freed by the action of the alternating current is removed.

817,960. George P. Craighill and George A. Kerr, Lynchburg Va. Assignors to N. C. Manson, Jr., same place. **Treating wood**. In the production of wood paper pulp and the extraction and recovery of the volatile and resinous constituents of the wood it is first treated chemically under moderate heat to liberate the terpenes and fix the volatile acids and oils, the terpenes being carried off and recovered. The wood is further digested at a moderate temperature in the same chemical solution, and the solution and resinous substances are then drawn off; the residual fibrous substances are subjected to the action of a solution of caustic soda under pressure, and then to a solution of carbonate of soda, and finally to the bleaching action of chlorinated soda.

817,963. Octave Devillers, Jumet, Belgium. **Plates imitating marble**. A quantity of multicolored glass is heated to a plastic state and then reduced to flakes or scales, which are distributed upon a sheet or plane of glass, and subsequently heat sufficient applied to fuse the flakes and sheet of glass.

817,988. Gust A. Riddle, Pittsburg, Pa. Assignor two-thirds to J. W. Fritts and C. W. Mathewson, Pittsburg, Pa. **Manufacture of brick**. A composition consisting of ground or pulverized ganister stone 9 parts, silicate of soda 1 part, water

1 part and glycerol is added twelve drops to each gallon of silicate of soda solution.

818,044. Samuel Parfitt, Cardiff, England. **Making metallic compounds.** In the manufacture of metallic compounds, of which decarbonized iron is the basic or principal constituent, the iron is melted and treated so as to produce a product containing not more than one-tenth of 1 per cent. of carbon, and to it is added metallic aluminum 0.5 per cent. and metallic tungsten, 0.3 per cent.

818,124. Keizo Sakurai, San Francisco, Cal. **Treating clays.** Clay containing gypsum is heated to a temperature of approximately 200° to reduce the gypsum to the condition of dead burnt gypsum, a suitable binder is mixed with the heated material to form a paste, which latter is molded and dried.

818,174. Charles E. Holland, New York, N. Y. Assignor to the Holland Metal Recovery Co., New York, N. Y. **Reclaiming waste gold, etc.** Gold and other valuable metals are recovered from water or other liquids by causing the liquid to flow into and continuously through a run-way or tank and subjecting it to electrolysis in the presence of a substance capable of forming a coagulum; the coagulum and precipitate formed by the electrolytic process are removed, and the liquid evaporated, decanted or filtered off, and the residuum is subjected to a separating process for the recovery of the metal.

818,192. Charles Ranson, Brussels, Belgium. Assignor to Henry William DeStuckle, Dieuze, Germany. **Making caustic alkalies and zinc sulphide.** Zinc in excess is treated in the presence of alkali hydroxides with an alkali sulphide which is no greater in quantity than is necessary to transform zinc-alkali oxide, as zinc-sodium oxide, into zinc sulphide and caustic alkali.

818,206. Marius LeNormant des Varannes and Antoine R. de Vains, St. Vincent de Blanzat, France. **Making paper pulp.** After paper pulp has been completely finished and before it has been sized it is freed from metallic particles by treatment with gaseous chlorine whereby the metallic particles are converted into soluble chlorides which are removed by washing.

818,221. Oscar Bender, Treptow, near Berlin, Germany. **Method of combustion.** Intermingled steam and air are introduced into a bed of solid fuel in a state of combustion, a hydrocarbon vaporized with exclusion of air, and all the gases finally intermingled within the bed of the fuel.

818,287. Eugene S. Powers, Merchantville, N. J. **Treating clay.** A process of making plastic products which consists in mixing clay 4, and sand 8 parts, adding and mixing a solution of water glass, and molding the composition; an oxide is then caused



to form on the exposed surface by an air blast and the whole heated, the oxide being thus made to form a crystallized crust.

818,336. Oscar Bally, Mannheim and Hugo Wolff, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin and Soda Fabrik, same place. **Blue dye.** A coloring-matter which can be obtained by treating chlorbenzanthrone with a caustic alkali; it dissolves in concentrated sulphuric acid yielding a violet-brown solution, and dissolves in alkaline hydrosulphite yielding a bluish red vat which dyes vegetable fiber substantively yielding blue shades.

818,341. Wilhelm Behaghel and Gustav K. Schumann, Ludwigshafen-on-Rhine, Germany. Assignors to Badische Anilin and Soda Fabrik, same place. **Making phenylglycin salts.** Chloracetic acid is acted upon by an excess of aniline until the phenylglycin is converted into its aniline, the anilid which is separated and saponified with a caustic alkali.

APRIL 24, 1906.

818,648. Salo Wohle, London, England. **Detergent.** A detergent for scouring wool consisting of linseed 2, water 40 parts and stripped horse chestnuts 12, water 40 parts, to which carbonate of soda has been added, castor oil  $\frac{1}{2}$ , a feeble vegetable acid  $\frac{1}{20}$ , and sodium peroxide  $\frac{1}{12}$  part.

818,754. Sidney S. Emery, Woodbury, N. J. Assignor to The Eastern Dynamite Co., Wilmington, Del. **Making aluminate of soda.** Bauxite, sulphate of soda and carbonaceous matter are calcined in the presence of an air blast, an aluminate of soda being formed, free from impurities.

818,833. Jacob Laeuffer, Lima, Ohio. **Substitute for wood.** A composition intended to be used as an artificial wood or substitute material consisting of vegetable matter 70, Portland cement 30, plaster of Paris 4, sulphur 1, and swine blood to moisten the mass are mixed.

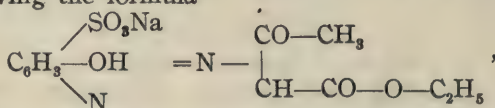
818,918. Marcus Ruthenburg, Lockport, N. Y. **Manufacturing iron and its alloys.** Comminuted particles of ore are assembled so as to form a path for an electric current and so proportioned as to frit the particles into coherent lumps; the lumps are collected in a confined heated atmosphere, and before the lumps have fallen below the reducing temperature they are subjected to the action of a deoxidizing gas until they are reduced without being melted, and finally the reduced lumps are melted by passing through them an electric current.

818,939. Hans von Dahmen, Vienna, Austria-Hungary. **Exploding high explosives.** In order to completely explode aluminum explosives, or all high explosives, picric acid, guncotton, etc., the explosive is mixed with lead peroxide, sulphur, carbon

and potassium nitrate; the whole is filled into a strong container, to one end of which a gunpowder fuse is attached.

818,980. Albrecht Schmidt, Höchst-on-Main, Germany. Assignor to Farbwerke vorm. Meister, Lucius und Brüning, same place. **Sulphur dye and process of making.** Hydroxylated azines and sulphurized dyestuffs derived from them are heated with alkali polysulphide in the presence of substances containing copper. The product is soluble in sulphides of alkali metals when heated, and dyes unmordanted cotton red, dark red to violet in a bath of sulphides of alkali metals, the dyeings thus obtained turning muddy and afterward mostly blue when treated on the fiber with copper salts.

818,981. Franz Scholl, Höchst-on-Main, Germany. Assignor to Farbwerke, vorm. Meister, Lucius und Brüning, same place. **Yellow dye and process of making.** A yellow mordant dyestuff having the formula



which is obtained by the action of the diazo compound of *o*-aminoparasulphosalicylic acid on ethyl acetoacetate, and is a yellow crystalline powder readily soluble in water with a yellow color, which on the addition of mineral acids becomes lighter, and darker on addition of alkali; soluble in concentrated sulphuric acid with a greenish yellow color, and insoluble in alcohol and petroleum ether.

818,992. Oscar Bally and Max H. Isler, Mannheim, Germany. Assignors to Badische and Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Anthracene dye and process of making.** The benzanthrone compound which is obtained by condensing together oxanthranol and glycerol is treated with caustic alkali forming an anthracene coloring-matter which dissolves in concentrated sulphuric acid yielding a blue solution, and dissolves in alkaline hydrosulphite yielding a bluish red vat which dyes vegetable fiber substantively yielding violet shades.

819,012. Edward Hardcastle, Stockport, England. **Composition of matter.** A compound which forms an emulsion with water to be applied to the surfaces of roads or other places to lay dust, consisting of coal-tar creosote 350, and a resinate of soda 200 parts, holding 100 parts of pitch or asphaltum in solution.

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819,125. George D. Coleman, Boston, Mass. **Antifouling paint.** A ship's bottom is coated with paint and finely divided copper sprinkled over it while tacky, rubbed in and burnished,

the process repeated as often as required with copper more finely divided, the last coat being paint without copper and polished.

819,127. Henry L. Doherty, New York, N. Y. Assignor to Combustion Utilities Co., same place. **Promoting combustion** A stream of producer gas is led into a rotary cement kiln and a stream of powdered coal projected across its path, the mixture being made in an igniting temperature in the presence of air.

819,218 to 224 inclusive. Herman L. Hartenstein, Chicago, Ill. Assignor to Electro-Chemical and Developing Co., Pierre, S. D. These patents all relate to **calcium carbide**, the first to a superheating compound of calcium carbide 60, coal 15, aluminum 3 and an oxygen compound as  $\text{MnO}_2$  20 and  $\text{KClO}_3$  2 parts by weight which also eliminates the phosphorus from the carbide; the second for fusing lime and progressively increasing quantities of carbon; the third for cooling the carbide in thin sheets; the fourth for coating the inside of a carbide mold with tar and fine coke; the fifth for preheating and superheating the charge to economize heat in the transfer from furnace to furnace; the sixth for making a furnace lining of slaked lime, powdered coke, asbestos and hydrocarbon; and the last for an electric furnace having all parts adjustable, the two sets of electrodes being in the top member of two cone furnaces.

819,249. Frederick C. C. T. A. Osius, Muskegon, Mich. **Dental filling**. Powdered gold and a dental cement as zinc cement mixed and ground together, the compound burnishing like gold.

819,262. Otto Baither, Griesheim, Germany. Assignor to Chemische Fabrik Griesheim Electron, Frankfurt-on-Main, Germany. **Concentrating nitric acid**. Dilute nitric acid is mixed with sodium polysulphate in a still at  $110^\circ$  to  $130^\circ$  at which temperature concentrated nitric acid goes over into a storage vessel, then increasing the temperature to  $300^\circ$  when dilute acid goes over first, finally water. The dilute acid is put into the next operation, the polysulphate ( $\text{H}_3\text{Na}(\text{SO}_4)_2$ ) cooled off in the still, and the operation repeated.

819,348. Paul Friedlander, Vienna, Austria-Hungary. Assignor to Kalle und Co., Aktiengesellschaft, Biebrich, Germany. **Red sulphur dye**. Made by oxidizing thioindoxyl compounds



of the constitution  $\text{C}_6\text{H}_4 \begin{array}{c} \diagup \quad \diagdown \\ \text{C} \quad \text{CX} \\ \diagdown \quad \diagup \\ \text{S} \end{array}$  being H or  $\text{COOH}$  and which

are red powders insoluble in most solvents but subliming without decomposition in brilliant bronze colored needles, and giving a yellow solution on reduction, from which the color is precipitated by an air blast.

819,383. Austin V. M. Sprague, New York, N. Y. **Sterilizing**



**surgeons' tools.** The articles are put in a closed chamber in which a vacuum is produced and a blast of air saturated with formalin is driven through the apparatus.

819,410. Adolf Clemm, Mannheim, Germany. **Making chlorine.** An acid phosphoric salt and a chloride are mixed in solution, and then electrolyzed, whereby chlorine and citric acid-soluble phosphate are made.

819,450. Frederick C. Overbury, New York, N. Y. Assignor to Flintkote Manufacturing Co., Rutherford, N. J. **Waterproof fabric** for applying to walls, etc. One side is coated with asphalt, the other left uncoated which is adhesive to a coated wall.

819,467. Edward R. Stowell, Portland, Ind. **Fireproof cement bricks.** Carborundum 85 and Portland cement 15 per cent.

819,506. Henry S. Blackmore, Mt. Vernon, N. Y. **Combustible hydrocarbon.** A mixture of a ketone and superheated steam is exposed to the action of red-hot carbon. If acetone be the ketone, methane will be made.

819,529. Ferdinand Ephraim, San Francisco, Cal. **Vulcanized material.** The entire rubber-containing plant is crushed; mixed with suitable vulcanizing material, and vulcanized for use in making door mats, etc.

819,595. Peter Prins, Minneapolis, Minn. **Making straw board.** Chopped straw is mixed with 6 per cent. of quicklime in a closed retort, and the mass is stirred for three and one-half hours with steam at 5 atmospheres pressure, the mass is then ground, passed through the beater, filtered and partially dried, pressed and rolled into sheets.

819,646. Joseph Glatz, Brooklyn, N. Y. **Candle material.** Fats or fatty acids are treated with ammonia under a pressure of 10 to 50 atmospheres for from ten to twenty hours at a temperature of 150° to 250°.

819,660 to 666 inclusive. Leon P. Lowe, San Francisco, Cal. The first a **U-shaped gas washer**, the second the process of **making oil gas** by passing highly heated products of combustion through a hot stove, then shutting off the air and fuel and sending a hydrocarbon and steam through with air and repeating the operation. The remaining patents are for the special arrangements of **stoves, etc.**, for carrying out the process.

819,696. Wm. Y. Gambee, New York, N. Y. **Fire brick.** Cement 1, ground slate and cinders 2 parts each.

819,704. Max Bamberger, Friedrich Bock and Friedrich Wanz, Vienna, Austria-Hungary. **Reoxidizing exhaled air.** A vessel for the sodium peroxide is adapted to rotate and is provided with tubes connecting with the breathing space, and a

two-part framing adapted to lock the vessel in an operative position or to release it.

MAY 8, 1906.

819,751. Giuseppe Gianoli, Milan, Italy. **Charging silk.** The silk is treated with an alkaline sulphocyanide, and an acid of a strength of 1 to 3 per cent. of the sulphocyanide which does not injure the silk as much as the tin salt commonly used.

819,765. Wm. Kiel, Butler, N. J. Assignor to American Hard Rubber Co., New York. **Chemical vessel.** A container for chemicals formed of an interior layer of hard rubber and an exterior layer of soft rubber roughened on the outside, the whole vulcanized together.

819,833. Edward J. Yetter, Denver, Colo. **Roofing composition.** Gilsonite, lime sludge and asphaltum, with or without oil, combined in various proportions.

819,901. Charles S. Maschal, Kingston, N. Y. **Medicated pencil.** A stick of sterilized wood carrying on the end a ball or pellet of silver nitrate, etc., adapted to be removed by wetting.

820,000. John A. Just, Pulaski, N. Y. Assignor to Just Mining and Extracting Co., Syracuse, N. Y. **Recovering precious metals.** A mixture of nitric acid or saltpeter 10 parts and sulphuric acid 200 parts is made and the pulverized ores of gold or silver treated with it, the precious metals then precipitated by zinc or iron.

820,031. Thomas L. Wilson, New York, N. Y. Assignor to Union Carbide Co., Va. **Reducing calcium oxide.** A mixture of calcium oxide and carbon is placed in a crucible of carbon covered by a heavy slab through which drops the electrode to near the bottom of the crucible and embedded in the charge, the electrode being gradually moved up as the reaction involves more and more of the charge.

820,039. Edward J. Duff, Liverpool, England. **Recovering ammonia from gas.** The gas is first scrubbed with water, then with dilute sulphuric acid, the two solutions resulting are mixed and the ammonia separated.

820,099. Frank Damhorst, August Keniper and Ernst Utke, Berlin, Germany. **Powder for dusting founders' patterns.** Consists of finely pulverized calcium carbide.

820,121. Wm. F. Morang, Manchester, N. H. Assignor to Morang Chemical Co., same place. **Compound for bleaching sole leather.** Epsom salts and sodium hyposulphite 60, borax 40, potassium permanganate 2, oil of mirbane 1, and water 25,000 parts.

820,133-4. Elfego Riveroll, Los Angeles, Cal. **Smelting ore.** Furnace and process. The ore slides down an inclined shaft

furnace meeting near the bottom a blast of burning petroleum gas, and the melted metal drains into a tank in the bottom of the horizontal part of the shaft furnace.

820,159. Julius Weise, Friedrich Rieche and Adolph Barth, Oestrich-on-Rhine, Germany. Assignors to Rudolph Koepp and Co., same place. **Making formates.** Carbon monoxide is forced through an aqueous solution of an alkali in a closed vessel at a high temperature (above  $100^{\circ}$ ) with agitation.

820,162-3. Edward J. Yetter, Denver, Colo. **Roofing compound.** The first is for elaterite 1, lime sludge 2, an oil and asphalt according to the consistency desired, and the second adds to the compound gilsonite. Gilsonite and elaterite are asphaltic minerals found in West Va. See patent 620,082. Lime sludge is a waste from sugar manufacture.

820,196. Stanislaus J. Hon, South Bend, Ind. **Artificial fuel.** Crude oil 100, rosin 50, oxide of lead 5, ground iron ore 13 parts, heat till liquefied, then add a ton of earth as a fuel-supporting core.

820,283. Charles Clamond, Paris, France. Process and apparatus for **separating mixed gases.** A supply of mixed gases is forced intermittently through a pipe provided with outlets at various places along its course, their position being determined by the supposed location of points in the waves produced by the impulses where the separate gases collect in greater quantity according to their density, the heavier molecules moving further along the tube than the lighter ones. The impulses may be given by a siren, etc.

820,315. Wm. Polatsik, Chicago, Ill. Assignor to himself and Joseph L. Bloom, same place. **Rubber substitute.** Four parts calcium acetate are dissolved in 80 parts water, and 100 parts animal waste soaked in it forty-eight hours; it is then transferred to a solution of strontium chloride of the same strength for the same time, a little ferric sulphate being added.

820,351. Lucien Crespin, Paris, France. **Artificial silk.** Nitrocellulose is dissolved in a mixture of ethyl and methyl alcohol and sulphuric ether to which a small amount of castor oil, palm oil or glycerol has been added, the mixture is forced through a capillary tube into a water-bath from which a part of the solvents is recovered.

820,373-4. Julius Weise, Friedrich Rieche, and Adolf Barth, Oestrich-on-Rhine. Assignors to Rudolph Koepp and Co., same place. **Making formates.** In the first carbon monoxide is forced through a solution of an alkaline earth in a closed vessel at a high temperature. The second uses an alkaline carbonate in place of the alkaline earth.

820,379. Oscar Bally and Max H. Isler, Mannheim, Germany.



Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. **Anthracene dye.** Benzanthrone obtained from naphthanthraquinone is treated with caustic alkali, the product is soluble in sulphuric acid olive-green, but gives a reddish brown vat in an alkaline hydrosulphite, dyeing green-blue shades on cotton.

MAY 15, 1906.

820,392. Edward A. Cook, Giatto, West Va. Assignor one-third to Timothy W. Paton, Bluefield, West Va. **Shoe polish.** Castor oil 100, sperm oil 15, powdered charcoal 6 and extract of lemon 2 parts by weight.

820,430. Charles W. Merrill, Lead, S. D. **Obtaining precious metals.** The crushed material is put in a closed container, a cyanogen-bearing solution is applied, the solution is removed and air under pressure forced through it and the operation repeated. Bleaching-powder solution may be used in place of air as an oxidizer.

820,442. Walter T. Scheele, Baltimore, Md. Assignor to Wm. J. Hooper, same place. **Preserving by liquid air.** A closed tank provided with a relief valve is divided horizontally by a perforated partition adapted to support the material to be preserved, and a delivery pipe extends down into the lower chamber by which liquid air is fed into the lower chamber.

820,484. Henry L. Doherty, Madison, Wis. Process of **burning cement clinker.** A stream of Portland cement material is fed into the upper end of an inclined rotary kiln, together with a definite amount of coal mixed with products of combustion, and in varying the amount of the latter so that a constant shifting of the clinker zones is effected.

820,485. Byron E. Eldred, New York, N. Y. **Making gas.** A deep bed of hot fuel is alternately blasted with air and gases from a blast-furnace, the gas from the latter operation is collected, cooled, washed and delivered to a gas engine.

820,501. Paul Julius and Edward Munch. Assignors to Badische Anilin und Soda Fabrik, all of Ludwigshafen-on-Rhine, Germany. **Blue sulphur dye.** Chloranil is made to react on unsymmetrical dialkyl-*p*-phenylenediaminethiosulphonic acid in the presence of sulphur or sulphur compounds. A violet-black powder slightly soluble in hot water blue, easily soluble in concentrated sulphuric acid blue-green, slightly soluble in aniline and phenol, yielding green to blue-green solutions, soluble in glacial acetic acid, alcohol and acetone, dyeing cotton direct green-blue.

820,524. Joseph Schneible, Weehawken, N. J. **Purifying water.** Talc or similar material is put in a tank from which it is fed through pulverizing rolls into a flowing stream of water.

820,525. Frederick W. C. Schniewind, Everett, Mass. Assignor to United Coke and Gas Co., Charleston, West Va. **Making gas.** Illuminating gas is drawn off first from the carbonizing retorts, and the poorer gas afterwards into separate receptacles, treating the latter for its more condensable illuminants, and sending the uncondensable gases into the first lot.

820,555. Benvenuto Comba, Turin, Italy. Assignor to Edward Casper, London, England. **Recovering copper.** A cathode is immersed in a copper solution with a lighter liquid as acidulated water above it, the iron anode being supported in said supernatant liquid, and in direct contact with the cathode, whereby an electric current is produced and copper deposited on the cathode.

820,587. Norman Marshall, Newton, Mass. **Phosphorus compound for neurasthenia.** The brains of cattle and the marrow are skinned and washed in common salt, then mixed with the *Spiritus etheris* of the Pharmacopoeia Germanica, forming an extract which is filtered, the ether distilled off, the product mixed with blood, serum, spermin and sodium phosphate till the mass hardens, and may be pulverized.

820,648. Emile F. Kick, New York, N. Y. Assignor to American Chemical Products Co. **Purging hides and skins.** The limed hides or skins are treated with sodium sulphuricinate together with ammonium chloride.

820,705. Warner R. Crowell, Boston, Mass., and Nicholas B. Varina, Aurora, Ill. **Compound for filling brakeshoes.** Coal tar and ground coke 5 each, India rubber 3, tallow 2, powdered shellac 4, sal ammoniac 1, finely divided particles of steel and of iron 40 parts each by weight.

820,806. Albert G. Manns, Chicago, Ill. Assignor to Food and Fiber Products Co., same place. **Food extract from corn-stalks.** A friable solid water extract of cornstalks with less than 10 per cent. of water and low in crystallizable polyoses but high in protein, phosphates and uncrystallizable sugar.

820,810. Sidney T. Muffley, Philadelphia, Pa. Assignor to Philadelphia Cyanide Process Co., Wilmington, Del. **Extracting precious metals.** The pulverized ores are treated with alkali, then continuously conveyed through successive bodies of cyanide solution under air pressure, the fumes of hydrocyanic acid evolved being absorbed in alkaline hydroxide solutions, forming cyanide solutions for further use, and the vapors of base elements being precipitated from said fumes.

820,811-2. As above for **apparatus** for carrying out said process. Consists chiefly of a series of cylindrical leaching tanks arranged stepwise and having agitators and supply tanks, with the necessary connecting pipes.

820,813. As above for **recovering metals from gases**. Metallic elements carried in gases are recovered by passing the mixture through thin films of solutions of a cyanide and bromine under pressure, precipitating the base metallic compounds by ammonia, and recovering the other metals by electrolysis.

820,824. Curt J. Roehr, Philadelphia, Pa. Assignor to self and Wm. F. Parry, same place. **Treating distillery slop**. Dilute sodium silicate is added to hot distillery slop, whereby the slop is neutralized and the protein contents precipitated.

820,830. Friedrich Stolz and Baptist Reuter, Höchst-on-Main, Germany. Assignors to Meister, Lucius und Brüning, same place. **Alkamine ester**. Diethylaminoethanol ester of *p*-methylaminobenzoic acid, a colorless compound which decomposes on heating with alkalies or acids into its constituents, melting below 0° slightly soluble in water, easily soluble in alcohol, ether and benzene, alkaline to litmus, uniting with hydrochloric acid to form a neutral salt that in solution may be used as an anesthetic.

820,854. Balthasar Eberle, Passaic, N. J. **Blasting powder**. Saltpeter 64, potassium chlorate 24, sugar 24, phosphorus 3, sulphur 12 and horse manure 16 parts by weight.

820,859. Adrien Gacon, Mont Val, near Marly-le-Roi, France. **Making artificial emery**. Bauxite 769, coke 513, nitrate of soda 50 and sawdust 250 parts are mixed to a pasty mass with water, made into loaves or cakes and furnaced, then crushed.

820,869. Henry S. A. Holt, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Prepared indigo**. An alkali solution of a leuco-indigo compound is oxidized in the presence of soft soap.

820,884. Sidney T. Muffly, Philadelphia, Pa. Assignor to Philadelphia Cyanide Process Co. **Apparatus for condensing gases**. A closed tank is provided with aprons united alternately to the top and bottom of the tank, whereby the gases are caused to zigzag through the liquid under pressure, suitable pipe connections being provided.

820,889. Karl Reinking, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Hydrosulphite discharging paste**. Contains besides undissolved hydrosulphite 60, glycerol 35, caustic soda 5 parts by weight and, British gum dissolved in saturated solution of sodium chloride sufficient to give proper consistency.

820,898. James N. Whitman, Philadelphia, Pa. Assignor to Marcus T. Reynolds, Albany, N. Y. **Making iron direct from oxide**. Powdered ore is heated with an air blast carrying free carbon to partially oxidize it, and the temperature is then raised to reduce it.



820,900. Robert Wimmer, Ludwigshafen-on-Rhine. Assignor to Badische Anilin und Soda Fabrik, all of Ludwigshafen-on-Rhine, Germany. **Reducing indigo.** Effected by iron powder in caustic alkali solution containing at least 6.5 per cent. solid caustic alkali.

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820,954. Gustav Chaudoir, Jr., Vienna, Austria-Hungary. **Alloy.** An alloy of copper containing from 0.75 to 3.5 per cent. of cadmium.

821,017. Walter G. Clark, New York, N. Y. Assignor to Parker-Clark Electric Co., Jersey City, N. J. **Electric conductor.** Made by decomposing a carbonaceous gas in the presence of a volatile silicon compound at a temperature lower than is required to make carborundum, making a substance which is a conductor of electricity when cold.

821,042. Isidor Kitsee, Philadelphia, Pa. Assignor to C. L. Hamilton and W. F. Hamilton. **Regenerating catalytic substances.** Platinum contact material is made a part of the anode of an electrolytic apparatus when a current is passed through it, whereby the "contact poisons," as arsenic, are eliminated.

821,189-90. John A. Potter, San Francisco, Cal. Process and apparatus for **smelting ores**, especially iron. A tubular column is arranged over an open-hearth furnace; through said column a mixture is forced into the furnace consisting of tar and limestone with iron ore both finely powdered. The column of ore and flux at first hardens so that it can be projected into the furnace where it is reduced.

821,200. Jan Sczcepanik, Vienna, Austria-Hungary. **Photographs in natural colors.** Registrable negatives are made of objects having primary color values; diapositives are made from such negatives, a superposed transparent three-ply film is made in fadable actinic primary colors, the diapositives are printed on the film under the influence of light complementary in color to that represented by the respective diapositive, and the transparent mirror print so made is fixed on actinic paper ruled with fadable primary colors, and the latter print also fixed.

821,244. Charley M. Hulsey, Frost, Texas. **Compound for killing grass.** Kerosene 150, soda 2, alum  $\frac{1}{4}$ , and citric acid  $\frac{1}{20}$  part.

821,260. Heinrich Schowalter, Ladenburg, Germany. **Oil dressing for leather.** Train oil 900, aniline oil 15 and a solution of rubber in turpentine 3 parts.

821,291. Alexis C. Houghton, Syracuse, N. Y. **Benzoyl succinyl peroxide.** A monobasic peroxide derived from benzoic peracid and the anhydride of succinic acid, which is a colorless

crystalline body with aromatic odor and sharp peppery taste, soluble in alcohol, chloroform and benzene, melts at  $96^{\circ}$  and in contact with water gradually decomposes into benzoic peracid and succinic peroxide, and is an intense germicide.

821,316. Ferdinand C. Schedtman, St. Louis, Mo. **Sash-weight.** The weight consists of a core of ground barytes cemented by rosin and coated with a shell of metal as iron cast around it.

821,330. Anson G. Betts, Troy, N. Y. **Smelting lead sulphide ores.** Galena is smelted with carbon, iron oxide and sodium carbonate to get metallic lead and an iron-sodium matte having the formula approximately  $\text{Na}_2\text{SFeS}$ .

821,378. Christopher Ris, Basle, Switzerland. **Blue sulphur dye.** Dimethyl-*p*-phenylenediamine and  $\alpha$ -naphthol are changed to leuco-compounds and heated with polysulphides of alkalis, forming dark blue powders, insoluble in water, soluble in alcohol and benzene blue, in sodium sulphide solution green, and in concentrated sulphuric acid brown.

821,394. Paul Alexander, Charlottenburg, Germany. **Re-generating rubber.** Rubber is dissolved in any solvent as benzene, then strong aqueous alkali is added, and the solvent distilled off by steam, the rubber being thus transferred to the aqueous liquid; the impurities are separated by filtration, and the caoutchouc precipitated by an acid.

821,434. Gustav Sachsenroder, Barmen-unter-Barmen, Germany. **Artificial parchment.** Agents as metallic soaps capable of waterproofing and making the paper opaque are added to the parchmentizing plant.

821,452. Heinrich A. Bernthsen, Mannheim, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Rhodamine dye.** Phthalimide is condensed with monoalkyl *m*-aminophenol, saponifying the raw material obtained, a benzamide, and condensing the product with *p*-methyl-*m*-amidophenol, and esterifying the product which is more yellow than the rhodamines before known, and which perhaps has the formula  $\text{C}_7\text{H}_5\text{OOC}-\text{C}_6\text{H}_4-\text{C}$ .

821,457. Carl Bosch, Ludwigshafen-on-Rhine, Germany. Assignor to Badische Anilin und Soda Fabrik, same place. **Pure cyanogen compounds.** Pure alkali cyanide is made by distilling in a vacuum crude cyanide melts with an ammonium salt as ammonium chloride in the presence of water, and treating the ammonium cyanide which distils over with caustic alkali.

821,516. Thomas J. Lovett, Chicago, Ill. **Recovering copper, etc.** Chalcopyrite ores containing magnetic iron are crushed dry, the loose iron separated magnetically, grinding the remainder wet, and repeating the magnetic separation of iron, and concentrating the sulphides remaining.

821,550. Zane B. Taylor, Orbisonia, Pa. **Artificial stone.** Crushed slag 6, lime 50, alumina 12 and magnesia 4 parts with cement 20 and loam 20 parts each, and sufficient water to make the mass plastic.

821,555. Cornelis H. J. van Haften, the Hague, Netherlands. **Manure from peat.** Ground peat is mixed with water, ammonia gas circulated through the mass, and the ammonia sucked off.

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821,620. Henry V. Dunham, Bellows Falls, Vt. Assignor to Casein Co. of America, N. J. **Casein solution.** Casein is dissolved in alcohol and an alkali hydroxide soluble in alcohol, and formaldehyde added to the mixture. When dried, the compound is insoluble in water.

821,625. Thomas A. Edison, Llewellyn Park, N. J. Assignor to Edison Storage Battery Co. **Eliminating impurities from storage batteries.** Batteries having depolarizing masses of nickel oxygen compounds, must have a suitable anode in an opposite position in an alkaline solution, have a reverse current passed through the mass to generate hydrogen and raise the temperature, whereby the impurities will be driven into the solution which may be poured off.

821,626-7-8. Thomas A. Edison, Llewellyn Park, N. J. **Making metallic films.** A thin film of a soluble metal as zinc is deposited on the copper cathode, then an insoluble metal as cobalt or nickel is put on top of it, and finally the soluble metal is dissolved off by a weak acid solution and the insoluble metal film is thus stripped. In the second chlorides of nickel or cobalt, either singly or together are deposited in scale-like form, reduced to a hydroxide and then to a metallic state. The third fuses cobalt sulphide, cools it to crystallize out the metallic sulphur compound which is screened to separate the non-scaly part.

821,637. James O. Handy, Pittsburg, Pa. **Treating ores.** Arseniferous ores of cobalt and nickel containing silver are fused with sodium bisulphate to expel and recover arsenic, then leached and the silver reduced by a fresh portion of ore, the iron and residual arsenic being removed, and the cobalt and nickel separated by fractional precipitation with a hypochlorite, and the sodium salt recovered for re-use.

821,655. Hugo Lieber, New York, N. Y. **Radium surface.** A plate of celluloid whose surface is coated with an adhering radioactive film, and an exceedingly thin coating of a protective substance as a collodion varnish.

821,664. James A. Morris, Atlanta, Ga. **Spirometer.** A bottle is provided with an expansible bag resting on its bottom, which carries on top a sliding graduated rod adapted to move through the mouth of the bottle, and a tube for introducing the



expired breath into the bag which passes down the inside of the bottle.

821,718. John Janitzchek, Mt. Vernon, N. Y. **Mold for casting metals.** Made of plaster of Paris 3, slag wool and whiting 1 part each, ashes 2, and alum 1 part, and water 500, Sufficient to make a thin paste.

821,744. Jacob Reese, Sharon Hill, Pa. Assignor to Steel Patents Co. **Steel from phosphoritic iron.** The molten metal is desiliconized and decarburized in the Bessemer converter, the charge is then transferred to a basic-lined open-hearth furnace and treated to a basic bath with a percentage of phosphoric acid that, added to what is already in the metal, will give a slag of not less than 15 or more than 22 per cent., the temperature and fluidity of the bath being maintained during the additions to the molten metal.

821,844. Joseph Williams, Jr., Pittsburg, Pa. **Boiler cleaning compound.** Caustic soda 100, soda ash 12, saltpeter 8, sal-soda 20, water 1200 parts.

821,902. Henry S. Todd, Meriden, Conn. **Static electric machine.** The plate or cylinder is made of fibrous material saturated by immersion in a bath of sulphur.

821,928. Henry L. Day, Minneapolis, Minn., Fritz Dannert, Berlin, Germany. **Making gas.** A hydrocarbon is vaporized by the heat of a combustion chamber containing solid fuel, and the vapors thus generated are conducted into the zone of reduction of the glowing fuel, adding steam and leading off water and oil gas.

821,934. Archie P. Eves, Akron, Ohio. **Treating rubber.** Solvent vapors of acetone are passed upwards through the rubber and the condensed liquid allowed to percolate down through it, whereby the resinous impurities are removed.

821,947. Ephraim B. Melton, Decatur, Texas. **Preserving corn on the cob.** The fruit is washed in salicylic acid and lime-water and then exposed to the vapors from slaking lime which cooks it.

822,005. John B. Leonard, Memphis, Tenn. **Anti-slipping belt-compound.** Rosin 3, beeswax 2 and animal oil 5 parts melted together.

822,082. John W. Spencer, Newcastle-on-Tyne, England. **Making steel.** A charge of iron holding from 0.05 to 0.25 per cent. of carbon is kept melted and 0.75 to 2 per cent. of silicon introduced.

822,115. Karl Goldschmidt and Josef Weber, Essen-on-Ruhr, Germany. Assignors to T. H. Goldschmidt, same place. **De-tinning.** Compressed tin scrap is put in a vessel with fluid

chloride of tin in which chlorine gas is dissolved, the pressure being increased during the process and then diminished.

822,165. Wilhelm Traube, Berlin, Germany. **Dialkylbarbituric acids.** Dialkylmalonyl chloride is heated with 2 or 3 molecular weights of alkyl carbamates, evolving much hydrochloric acid and the dialkylmalonyldialkyl carbamates formed are treated with a condensing agent as sodium alcoholate, and boiled, then acidified by dilute acid when the diethylbarbituric acid precipitates as a crystalline solid.

822,171. Moriz Weinrich, Yonkers, New York, N. Y. **Purifying massecuite.** The solution is brought to 42° Baumé density, warmed to precipitate lime and impurities but not hot enough to form caramel, or destroy the fruit sugar, then a quantity of dry powdered lime is added equal to one-half to two-thirds the impurities present and the mixture carbonated.

822,175. Edson R. Wolcott, Golden, Colo. **Locating metals in the earth.** Two electrodes are buried in the earth which is moistened between them, and a current passed from anode to cathode, whereby metals in the vicinity will deposit on the cathode.

822,209. Albert C. Knight, Newark, N. J. **Illuminated wall paper.** Unprinted paper is coated with a mixture of starch, water and linseed oil, with the color desired to form a background, then the design is printed in the darkest and richest colors known as sized pulp colors, then washing off and rubbing the colors through stencils to make the high lights.

JUNE 5, 1906.

822,299. Carrie R. Plumer, Seattle, Wahington. **Hardening copper and its alloys.** Assigned to Renstrom Tempered Copper Co., same place. Copper sulphate and potassium bichromate are added successively to melted copper to freeze the mass, which is then remelted.

822,305. Auguste J. Rossi, New York, N. Y. Assignor of parts to James McNaughton, Tahawus, N. Y., Philip C. Peck and Janet McNaughton, of New York, executrix of said James McNaughton. **Steel containing titanium.** An amount of titanium oxide sufficient to decarburize the steel is introduced into steel of known carbon content and melted in an electric furnace, whereby the reduced titanium is incorporated in the steel.

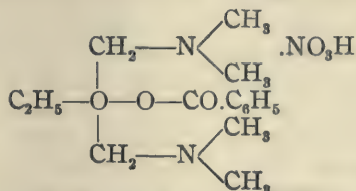
822,309. Wm. F. A. Schrader, Brooklyn, N. Y. Assignor to Traun Rubber Co., College Point, N. Y. **Scented rubber.** Crystallized powdered perfumes are incorporated with the pure rubber which is then calendered and vulcanized.

822,338. Edward Bennett, Pittsburg, Pa. **Pyrometer.** Two tubes of refractory material, one within the other have a resistance

body of one of the stable refractory oxides as zirconia or yttria which is a non-conductor of electricity when cold and located within the inner tube, and provided with refractory terminal leads.

822,339. Rudolph Behrendes, Elberfeld, Germany. Assignor to Farbenfabriken, same place. **Alkyloxyacetyl compound of pyrocatechinolmonoethyl ether.** Colorless liquids soluble in ether and alcohol, liberating the phenol compound by caustic alkalis and when made from guaiacol boiling at  $150^{\circ}$  under 10 mm. of pressure.

822,370. Fritz Hofmann, Elberfeld, Germany. Assignor to Farbenfabriken of Elberfeld Co., New York, N.Y. **Pharmaceutical compound.** A mono-nitrate of  $\beta$ -ethyltetramethyldiamino glycerol, being white crystals melting at  $162^{\circ}$  after drying, soluble in water and acetone, acting as an anesthetic and having the formula



822,373. Rudolph Knietsch, Ludwigshafen-on-Rhine, Germany. Assignor to General Chemical Co., New York, N. Y. **Purifying burner gases.** A steam jet is thrown into the gases, which are then cooled, washed and dried, then passed through a solution of sulphurous acid, whereby all impurities including arsenic are removed.

822,424. James F. Bottomley, Wellsend-on-Tyne and Arthur Paget, North Cry, England. **Fusing and shaping silica.** An internal resistance core is used in an electric furnace which is separated from the electrode and withdrawn from the plastic mass, which is taken out of the furnace, heated in an electrically heated chamber so as to glaze the exterior of the mass, which is then shaped while plastic.

822,430. James S. Cochran, Philadelphia, Pa. Assignor one-third to Frank Taylor, Wilmington, Del. **Cellulose.** The fuzz of cotton-seed, mechanically reclaimed after the lint is removed.

822,531. Leon P. Lowe, San Francisco, Cal. **Making gas.** Oil is sprayed by compressed gas pressure onto hot refractory material, until the material is cooled below the gas-making temperature, then admitting air to burn the oil and gas to reheat the material, and repeating the process as required.

822,532. Auguste Lumiere and Louis Lumiere, Lyon-Monplaisir, France. **Photographic plate.** A transparent base



carrying a layer of coarse and fine colored particles, a layer of varnish over the particles, and a sensitive layer on the varnish layer. Adapted for color photography.

822,548. Patrick H. O'Keeffe, Ramornie, South Grafton, New South Wales, Australia. **Preserving meat.** The meat is soaked in cold water, taken out and boiled in fresh water, salt-peter being added to the first water that serves to again soak the boiled meat in, which is then taken out and the solution boiled, cooled, sugar, salt and spices added, and the whole liquor used to pack the meat in.

822,556. Solomon Schwarzschild, Rochester, N. Y. **Protective compound for commercial writings.** The hydroxides, carbonates, bromides and iodides of sodium, potassium and ammonium are mixed together with lactic acid and water.

822,600. Thomas P. Gourley, New York, N. Y. **Fire brick.** Carborundum, sodium silicate, sulphuric acid and water.

822,672. Gustav Keil, Höchst-on-Main, Germany. Assignor to Meister Lucius and Brüning, same place. **Dialkyl malonyl urea.** Dialkyl malonyl thiourea is heated with solutions of salts of heavy metals.

822,712. Ralph Baggaley, Pittsburg, Pa., and Charles M. Allen, Lo Lo, Mont. Allen, assignor to Baggaley. **Primary baths for ores.** Sulphide ores in large lumps containing gold, silver, copper and iron are melted with full blast, whereby a melted bath is obtained of substantially the same metal content as the ore.

822,713. Ralph Baggaley, Pittsburg, Pa., and Charles Allen, Lo Lo, Mont., and Edward W. Lindquist, Chicago, Ill. Last two, assignors to Baggaley. **Using the sulphur of sulphide ores as fuel.** The ore is fed into a body of molten matte (see last patent) and a blast of air blown through the matte and also on top of it.

822,873. Samuel H. Thurston, Newark, N. J. **Coating metal.** A coating of metal particles is beaten into the surface of the metal to be coated, which is then electroplated, the first coating anchoring the second.

822,883. James S. Cochran, Philadelphia, Pa. One-third assigned to Frank Taylor, Wilmington, Del. **Cullulose.** After the staple is removed from cotton-seed the fuzz is loosened by grinding and rubbing, and then blown off.

WM. H. SEAMAN.

# REVIEW OF AMERICAN CHEMICAL RESEARCH.

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WILLIAM A. NOYES, Editor.

## REVIEWERS:

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E. C. Sullivan,  
F. P. Underhill,  
F. P. Veitch.

## GENERAL AND PHYSICAL CHEMISTRY.

**Technical Chemistry in Technical Schools.** BY H. P. TALBOT. *Technology Quart.* 19, 83-90.—The technical schools should teach science fundamentally from a somewhat abstract standpoint, endeavoring to educate rather than merely train the student. But in firmly inculcating principles their technical applications should be indicated when practicable. In the analytical laboratory "the effort will be made to develop a thoughtful, self-reliant worker rather than a man with a knowledge of particular methods," without, however, avoiding technical methods of desirable type. Both at the lecture table and in the laboratory the instruction should be in the hands of teachers of maturity and experience. There is some discussion regarding the proper scope of courses on "industrial chemistry."

W. F. HILLEBRAND.

**Historical Development of General Chemistry.** BY W. OSTWALD. *School Mines Quart.* 27, 87-117, 313-339, 388-413.—A course of six lectures delivered at Columbia University, New York, January 26th to February 2nd, 1906.

W. F. HILLEBRAND.

**Distribution of the Intensity of Radiation from Radioactive Sources.** BY E. RUTHERFORD. *Phil. Mag.* [6], 12, 152-8.—It is shown by a photographic method that the  $\alpha$ -particles are, on the average, projected equally in all directions from any infinitely thin radioactive source.

H. N. MCCOY.

**Retardation of the  $\alpha$ -Particle from Radium in Passing through Matter.** BY E. RUTHERFORD. *Phil. Mag.* [6], 12, 134-146.—The author determined the velocity of the  $\alpha$ -particle after passing through successive layers of aluminium foil, of equal thickness, by the method of magnetic deflection, in a vacuum. With RaC the velocity, after passing through 14 layers of foil, each equivalent in stopping power to 0.5 cm. of

air, was 43 per cent. of the initial velocity. No photo-effect could be obtained through more than 14 layers of foil. The energy of an  $\alpha$ -particle is decreased approximately 6 per cent. of the maximum by each layer of the foil traversed. A simple formula is deduced by means of which the initial velocity of an  $\alpha$ -particle of any substance may be calculated from its range, in terms of the initial velocity of the  $\alpha$ -particle of RaC. The calculated values agree well with those observed. The experiments show that the  $\alpha$ -particles from a thin layer of one kind of radioactive matter are all expelled with the same velocity and, after passing through an absorbing screen, all emerge with the same, though diminished, velocity. H. N. McCoy.

#### **On the Radioactive Matter in the Earth and the Atmosphere.**

By A. S. EVE. *Phil. Mag.* [6], 12, 189-200.—The number of ions produced in 1 cc. of air per second by the  $\alpha$ -rays of 1 gram of radium bromide at 1 cm. distance is  $3.1 \times 10^9$ , and the total number of ions formed by the  $\alpha$ -rays when the latter are completely absorbed by air is  $8.9 \times 10^{14}$ . Using this result and taking the amount of emanation in 1 cubic kilometer of air as equal to that produced by 0.5 gram of radium bromide, the author finds that the penetrating radiation from the air is less than one-twentieth as intense as that observed near the earth's surface. The observed penetrating radiation is ascribed chiefly to radioactive matter in the earth's crust, equivalent in amount  $1.8 \times 10^{-11}$  gram of radium bromide per cubic centimeter. This is seventy times as much radium as that calculated by Rutherford as necessary to explain the earth's temperature gradient, and four times as much as Strutt found by direct observation on ordinary rocks. H. N. McCoy.

**The Ionization Ranges of the  $\alpha$ -Rays of Actinium.** By O. HAHN. *Phil. Mag.* [6], 12, 244-254.—The ionization ranges of the products of actinium were measured by the method of Bragg and Kleeman, with special modifications previously used by the author for the similar study of thorium. Actinium itself is rayless as is also actinium A. The ranges, in centimeters of air, of the other products are: Radioactinium, 4.8; actinium X, 6.55; emanation, 5.8; actinium B, 5.50. Radioactinium decays to half value in about twenty days. If the products of actinium and of thorium are arranged in separate lists in the order of increasing range, it is found that corresponding products occur in the same sequence in each list, but no product of actinium corresponds to thorium C. H. N. McCoy.

**Are the Elements Transmutable, the Atoms Divisible and Forms of Matter but Modes of Motion?** By S. L. BIGELOW. *Pop. Sci. Monthly*, 69, 38-51.—The author presents in a popular,



yet scientific way, the important arguments which have led in the last few years to an affirmative answer to the questions proposed in the title.

H. N. McCoy.

**Of the Phenomena Observed in Crookes' Tubes.** By N. T. BACON. *Am. J. Sci.* **22**, 310-312.—The author suggests that the apparent decrease in pressure in a Crookes' tube, after prolonged use, may be due to the absorption of gases by the coating of spongy platinum deposited on the walls of the tube. The property of condensing gases is ascribed to lack of elasticity of the molecules of the platinum.

H. N. McCoy.

**The Rate of Recombination of the Ions in Air.** By L. L. HENDREN. *Physic. Rev.* **21**, 314-334.—The author determines the value of the coefficient of recombination of the ions by McClung's method. Radium is, however, used as the ionizing agent and the total change present in the gas when equilibrium is reached is determined by a method which has some advantage over that used by McClung. The effect of unequal distribution due to the absorption of the ionizing rays was investigated and found to be small. The diffusion of the ions was likewise taken into account. The coefficient of recombination decreased from 3300 at 760 mm. pressure to 1000 at 10 mm. pressure of the air, the rate of change increasing with decreasing pressure. While the coefficient decreases with decreasing pressure it does not decrease as rapidly as Langwin's results indicate.

C. A. KRAUS.

**The Heating Effects Produced by Röntgen Rays in Different Metals, and Their Relation to the Question of Change in the Atom.** By H. A. BUMSTEAD. *Phil. Mag.* **11**, 292-317; *Am. J. Sci.* **21**, 1-24.—When substances are exposed to the action of Röntgen rays they give off  $\beta$ -rays along with certain other secondary radiations. The author attempts to bring experimental evidence to bear on the question of the source of energy of these secondary radiations; whether, for example, the secondary radiations acquire their energy directly from the Röntgen rays or from the atoms of the substance itself, which are caused to disintegrate under the action of the Röntgen rays. If the energy is furnished by induced disintegration of the atoms, the greater portion of the energy accompanying this change would be transformed into heat in the substances themselves, and for equal absorption of Röntgen rays different substances would probably give rise to different amounts of heat. This the author tests for lead and zinc, by means of a radiometer. For equal absorption of Röntgen rays twice as much heat is generated in the lead as in the zinc. For details the original should be consulted.

C. A. KRAUS.

**A Periodic Relation between the Atomic Weight and the Index of Refraction.** BY F. L. BISHOP. *Am. Chem. J.* **35**, 84-86.—The author has collected the data relating to the index of refraction of the elements. On plotting these against atomic weight a periodic curve is obtained. In general, elements with greatest atomic volume have the smallest index of refraction.

C. A. KRAUS.

**The Progress of Physics in the Nineteenth Century.** BY CARL BARUS. *Science*, **22**, 353-368, 385-397.—Address before the Physical Section of the International Congress at St. Louis.

C. A. KRAUS.

**Titles of Article on the Hall Effect, with the Titles of Some Articles on the Related Phenomena Since Discovered by Other Investigators.** BY T. C. MCKAY, **41**, 385-395.—This collection of titles should prove very valuable to any one who has occasion to interest himself more particularly with the Hall effect and the numerous related phenomena.

C. A. KRAUS.

**Abnormal Polarization and Color of Light Scattered by Small Absorbing Particles.** BY R. W. WOOD. *Phil. Mag.* **12**, 147-149.—It was found that under proper conditions as, *e. g.*, in the presence of sealing-wax vapors, iodine vapor may be precipitated in the form of a cloud. This "fog," so to speak, scatters light of a deep red color, and it was found that the plane of polarization of the scattered beam is at right angles to the plane as observed in the case of non-absorbing particles. Similar results were obtained with *p*-nitrosodimethylaniline. It is suggested that the colored beam is due to a ray which is refracted internally in the drops, and the author was able to show that an uncolored beam may be obtained, though faint, polarized at right angles to the colored beam.

C. A. KRAUS.

**The Magneto-Optics of Sodium Vapor and the Rotary Dispersion Formula.** BY R. W. WOOD. *Phil. Mag.* **10**, 408-427.—The rotary dispersion of sodium vapor in a magnetic field was studied for wave-lengths between the D lines as well as for wave-lengths to either side. Rotations as high as  $1440^\circ$  were obtained with a field of 2000 C. G. S. units. The experimental values were found to agree with a dispersion formula based on the Hall effect. With crossed nicols a bright line spectrum was observed and photographed, a high vacuum being found necessary in bringing out the lines prominently. A portion of the red rotation spectrum was mapped out by a visual method.

C. A. KRAUS.

**The Fluorescence of Sodium Vapor and the Resonance Radiations of Electrons.** BY R. W. WOOD. *Phil. Mag.* **10**, 513-525.

—Repeated attempts have been made to detect a lateral emission of yellow light by sodium vapor, while in the act of absorbing sodium light. The author has succeeded in showing that non-luminous sodium vapor gives out a brilliant yellow light when illuminated by an intense sodium flame. If the illuminating beam be only approximately monochromatic, the sodium vapor emits light whose spectrum consists of a number of bright lines. A slight change in the wave-length of the exciting radiation causes a redistribution in the intensity of the lines, a slow change in the wave-length giving rise to a kind of scintillating effect. Different sources of light produce very different radiations from the vapor, some producing practically none. Because of the great absorptive power of the vapor, only the surface film of a dense vapor re-emits light. A considerable number of lines have already been measured. The lines may be divided into a number of groups with respect to their relation to the wave-length of the exciting source. The radiations from the vapor do not obey Stokes' law and in order to distinguish these radiations from ordinary fluorescent radiations the term "resonance radiation" is proposed. For many interesting details the reader should consult the original.

C. A. KRAUS.

**On the Theory of Fluorescence.** BY GERTRUD WOKER. *J. Physic. Chem.* **10**, 370-391.—The relation of the constitution of a large number of organic compounds to their fluorescence is considered. The mass of detail does not admit of a comprehensive summary in a brief space.

C. A. KRAUS.

**Magnetic Properties of Electrolytic Iron.** BY C. F. BURGESS AND A. HOYT TAYLOR. *Am. Inst. Electr. Eng.* **25**, 445-451.—Electrolytic iron has been prepared in the form of large plates an inch thick. The deposit was obtained from an acid solution of ferrous sulphate but details are not given. The metal contains an extremely large amount of hydrogen (0.083 per cent.) and is very hard and brittle. Some preliminary measurements are communicated on the magnetic constants. The work is being extended with the support of the Carnegie Institution.

C. A. KRAUS.

**The Partition of Energy.** BY W. F. MAGIE. *Science*, **23**, 161-178.—Address before the Physical Section of the American Association for the Advancement of Science in New Orleans, 1905.

C. A. KRAUS.

**A New Direct-Reading Electric Thermometer.** *Electrochem. Met. Ind.* **4**, 286-287.—Describes a new instrument called the "ratiometer," devised by Northrup of the Leeds Northrup Co. Two coils are so arranged between two pole pieces that the deflection is determined by the ratio of the currents flowing



in the two coils, independent of the actual magnitudes of the current. It may be very conveniently used for comparing two resistances which makes it applicable to temperature measurements with a resistance thermometer. The deflections are read by means of a telescope and a scale graduated in degrees of temperature and the whole instrument is put up in portable form. It may be made sensitive to less than  $0.1^{\circ}$ . This instrument should recommend itself where rapid temperature measurements are required.

C. A. KRAUS.

**A New Method of Standardizing Thermometers below  $0^{\circ}$ .**

By THEODORE W. RICHARDS AND FREDERICK G. JACKSON. *Pr. Am. Acad.* **41**, 449-454; *Z. physik. Chem.* **56**, 362-365.—The authors determine accurately the melting-points of mixtures of ice and hydrochloric acid solutions of different concentrations. Beginning with a mixture freezing at  $0.500^{\circ}$  below normal, values are given for the normality of the acid solutions for steps of  $0.500^{\circ}$  ending with  $4000^{\circ}$  as follows: 0.139, 0.277, 0.409, 0.538, 0.663, 0.773, 0.886, 0.997 equivalent of hydrochloric acid per liter. By determining the thermometric reading and the concentration of the solution the above data make it possible to calibrate a thermometer with comparative ease.

C. A. KRAUS.

**The Transition Temperature of Sodium Bromide. A New Fixed Point for Thermometry.**

By THEODORE W. RICHARDS AND ROGER C. WELLS. *Z. physik. Chem.* **56**, 348-361; *Pr. Am. Acad.* **41**, 435-448.—The transition temperature of pure sodium bromide is shown to lie at  $50.674^{\circ}$ , according to the international hydrogen scale. The heat accompanying this change is approximately 19 kilojoules per gram-molecule (heat of fusion of ice equals 5.8 kilojoules). One per cent. of impurity would accordingly lower the freezing-point about  $1^{\circ}$ . The authors show that sodium bromide can not be purified by crystallization. They describe various methods which were employed in preparing sodium bromide. While only a sodium bromide of a purity requisite for atomic weight determinations gives a constant freezing-point, a salt can be prepared without great difficulty, giving the true transition point within  $0.01^{\circ}$ .

C. A. KRAUS.

**The Growth of the Ice Crystal in the Bunsen Ice Calorimeter.**

By H. T. BARNES AND A. S. B. LUCAS. *Trans. Roy. Soc. Canada*, **10**, Part I, Sec. III, 33-39.—It has been found that the reading of an ice calorimeter changes slowly with the time. C. V. Boys has ascribed this change to the formation of ice crystals in the calorimeter, due to the fact that the surrounding ice jacket is a little below zero in consequence of the presence of impurities. The authors test this point experimentally, using fresh snow and cracked ice in the jacket. In addition, the water in the calorimeter

was under an excess pressure of half an atmosphere, which would lower the freezing-point below that due to any possible impurity in the packing. In all cases, however, the reading increased and the formation of crystals could be plainly seen at the end of the experiment.

C. A. KRAUS.

**Note on an Apparently Accidental Formation of Frazil Ice in a Cryophorous.** BY JOHN COX. *Trans. Roy. Soc. Canada*, 10, Part I, Sec. III, 2-4.—In carrying out an experiment with the cryophorous before a class, a mass of unusually fine crystals was formed. In exhibiting them to the class, these crystals were shaken loose from the wall of the vessel and sank to the bottom so that they were covered by perhaps half an inch of liquid. Later experiments to reproduce this phenomenon failed. The author considers that it may possibly have a bearing on the production of frazil or anchor ice in the St. Lawrence.

C. A. KRAUS.

**On the Artificial Production of Frazil Ice, Together with Measurements of the Temperature Conditions in the Water.** BY HOWARD T. BARNES. *Trans. Roy. Soc. Canada*, 10, Part I, Sec. III, 29-32.—In previous work to explain the formation of frazil or anchor ice in the St. Lawrence, the author suggested that it was due to supercooling caused by the rapid withdrawal of heat from water while strongly agitated. Tests were made in the laboratory by passing a stream of supercooled air through a vessel of water surrounded by an ice jacket. It was found that measurable supercooling of the water resulted and masses of ice crystals accumulated on the thermometer bulb and the stirrer.

C. A. KRAUS.

**The Nature and Origin of Volcanic Heat.** BY ELIHU THOMSON. *Science*, 24, 161-166.—According to the author, volcanic heat owes its origin to the displacement of material under pressure against a resistance, the resistance being due to the confinement of the motion to a limited channel. A flexure in the earth's crust may bring a pressure to bear on some of the less resisting material, which may be looked upon as an extremely viscous liquid. The material flows slowly to regions of lower pressure and the temperature rises in consequence. Increasing temperature reduces the viscosity and eventually sets a limit to the temperature that may be attained.

C. A. KRAUS.

**The Thermal Constants of Acetylene.** BY W. G. MIXTER. *Am. J. Sci.* 22, 13-18.—Owing to discrepancies among the thermal constants of acetylene as determined by various observers, an investigation is made of these constants. The following values were obtained: Heat of combustion of 2.016 grams of hydrogen, 68,440 calories; heat of combustion of 24 grams of acetylene

C. A. KRAUS.

**The Dependence of Free Energy upon Temperature.** By J. E. TREVOR. *J. Physic. Chem.* **9**, 299-310.—A critical examination of the thermodynamic theory of free energy taken up in connection with recent papers by van't Hoff and Richards.  
C. A. KRAUS.

**Molecular Attraction, IV. On Biot's Formula for Vapor-Pressure and Some Relations at the Critical Temperature.** By J. E. MILLS. *J. Physic. Chem.* **9**, 402-417.—It is shown that Biot's formula does not hold in the immediate neighborhood of the critical point. The equation for the constant of molecular attraction (this Journal, **9**, 446) may be applied up to the critical point, and the constant may be calculated from the critical constants and molecular weight. Further, it is shown that the

**Molecular Attraction, V. An Application of the Theory to Ten Additional Substances.** BY J. E. MILLS. *J. Physic. Chem.* **10**, 1-38.—The equations which have been previously derived and applied (this Journal, **9**, 446) are applied to some further substances. Previous results are substantiated and the results as a whole are summarized. It is unnecessary to repeat here what has already been said in previous abstracts. C. A. KRAUS.

**The van't Hoff-Raoult Formula.** BY WILDER D. BANCROFT.  
*J. Physic. Chem.* 10, 319-329.—The simple van't Hoff equation



may be applied only in case the heat of dilution is zero. If the heat of dilution differs from zero, a correction must be introduced into the expression for the osmotic work. The author makes use of Cady's measurement on the heat of dilution of sodium amalgam and Ramsay's values for the apparent molecular weight of sodium in mercury, and shows that, taking into account the heat of dilution, the molecular weight of sodium in mercury is normal. The correction is likewise applied to solutions of sulphuric acid in water with satisfactory results. In these applications the heat of dilution was assumed independent of the temperature. The author discusses the bearing of the heat of dilution on the theory of concentrated solutions and is inclined to think that a quantitative theory of concentrated solutions may be developed along these lines.

C. A. KRAUS.

**The Molecular Aggregation of Liquefied Gases.** BY M. A. HUNTER. *J. Physic. Chem.* **10**, 330-360.—The author investigates the molecular weight of some substances dissolved in liquefied oxygen and methane. Measurements of vapor-pressure did not prove satisfactory so that the change in boiling-point was finally used for determining the molecular weights. Of the more common gases only ethane and ethylene were found to be soluble. While ethane in oxygen and ethylene in methane gave normal elevation of the boiling-points, ethylene in oxygen and ethane in methane give abnormally great elevations, about three times the normal value in the case of ethylene in oxygen. The author interprets his results to show an aggregation of the solvent molecules. This rests upon a misconception, since the molecular weight of the solvent, involved in the formula for the depression of the vapor-pressure, refers to the molecular weight of the solvent in the vapor phase and not to that in the liquid phase.

C. A. KRAUS.

**Surface Tension at the Interface between Certain Liquids and Vapors.** BY ARTHUR L. CLARK. *Pr. Am. Acad.* **41**, 361-381.—The author sets out to determine the surface-tension between liquids and liquids and between liquids and the saturated vapors of other liquids over large ranges of temperature. The apparatus used is necessarily very complicated and a description can not be given here. Measurements were made on the surfaces between olive oil and alcohol vapor, olive oil and liquid alcohol, glycerol and ether vapor, and glycerol and liquid ether. With alcohol the measurements were carried as high as  $240^{\circ}$  and with ether as far as  $200^{\circ}$ . In general, the results show that a liquid in contact with the vapor of another liquid behaves in the same way as a liquid in contact with its own vapor.

C. A. KRAUS.

**On a Method of Determining the Specific Gravity of Soluble Salts by Displacement in Their Own Mother-Liquor, and Its**

**Application in the Case of the Alkaline Halides.** By J. Y. BUCHANAN. *Am. J. Sci.* **21**, 25-40.—Instead of determining the specific gravity of soluble salts by weighing them in oil, the author weighs them in their own mother-liquor. The measurements must necessarily be carried out with the greatest care, for which reason it will scarcely come into use as a general method. For certain purposes, however, it possesses some advantages, since it gives, not alone the specific gravity of the salt, but likewise the specific gravity of the solution with which it is in equilibrium. The specific gravity of the chlorides, bromides and iodides of potassium, rubidium and caesium were determined in this way. The relations of the specific gravities of these salts and of the saturated solutions of these salts are discussed in connection with the relation of the elements in the periodic system.

C. A. KRAUS.

**Some Concentration Cells in Methyl and Ethyl Alcohols.** By J. HUNT WILSON. *Am. Chem. J.* **35**, 78-84.—Concentration cells of silver nitrate in the alcohols were studied at 0° and 25° with a view to testing the applicability of Nernst's formula. In the case of the more dilute solutions the agreement is as close as might be expected, but the deviations are considerable for the more concentrated solutions in methyl alcohol.

C. A. KRAUS.

**On the General Equations of the Theory of Solutions.** By J. E. TREVOR. *J. Physic. Chem.* **10**, 392-412.—A mathematical development of the equations underlying the theory of solutions.

C. A. KRAUS.

**The Bearing of Hydrates on the Temperature Coefficients of Conductivity of Aqueous Solutions.** By HARRY C. JONES. *Am. Chem. J.* **35**, 445-449.—The author adduces evidence to show that the increase in conductivity of aqueous solutions is in part due to reduction in the degree of hydration and consequent increase in ionic velocity. Those ions which exhibit the greatest hydrating power have the largest temperature coefficients. Data are collected for a number of substances which tend to bear out this view. Moreover, the temperature coefficients are greater in the more dilute solutions.

C. A. KRAUS.

**On Complex-Formation, Hydration and Color.** By GILBERT NEWTON LEWIS. *Z. physik. Chem.* **56**, 223-224.—The author's paper (this Review, **11**, 555) dealing with this subject has been criticized by Donnan, who ascribed the color changes to the formation of complex ions. The author points out that the formation of complex ions alone can not explain the observed facts although, along with the formation of hydrates, it may be a factor in the process underlying the color changes in question.

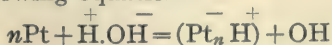
C. A. KRAUS.

**On the Properties of Electrically Prepared Colloidal Solutions.**

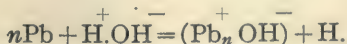
By E. F. BURTON. *Phil. Mag.* **11**, 425-447.—The diameters of the particles of electrically prepared solutions of gold, silver and platinum, by a modification of the method of Zsigmondy and Siedentopf, were found to lie between the limits  $(2-6) \times 10^{-5}$  centimeters. With an apparatus similar to that used by Hardy the migration velocities of colloidal solutions, electrically prepared, were measured in water, ethyl and methyl alcohols and ethyl malonate. In water, solutions of platinum, gold, silver, bismuth, lead and iron were employed and the observed velocities ranged from  $23.6 \times 10^{-5}$  for silver to  $11.0 \times 10^{-5}$  for bismuth. The first three metals wander toward the anode and the last three toward the cathode. The velocity is independent of the current used in preparing the solutions from which the author concludes that the velocity is independent of the size of the particles as is required by Lamb's theory according to which

$$v = \frac{VKX}{4\pi\mu},$$

where  $v$  is velocity of particle,  $V$  is the difference of potential between the particle and the liquid,  $K$  is the dielectric constant of the liquid,  $X$  is the potential gradient, and  $\mu$  is the coefficient of viscosity of the liquid. It further follows from this equation that the product  $v\mu$  should be constant for fixed potential gradient for a given solvent. This was tested for solutions of silver, at  $11^\circ$  and  $21^\circ$ . Under unit potential gradient the products  $v\mu$  were  $19.6 \times 10^{-5} \times 0.01282$  and  $25.2 \times 10^{-5} \times 0.00992$  or  $0.251 \times 10^{-5}$  and  $0.250 \times 10^{-5}$  at  $11^\circ$  and  $21^\circ$  respectively. The migration velocities of lead and bismuth in methyl alcohol were found to be  $22 \times 10^{-5}$  and  $10.2 \times 10^{-5}$  respectively; those of lead, tin and zinc in ethyl alcohol ranged from  $4.5 \times 10^{-5}$  for lead to  $2.8 \times 10^{-5}$  for zinc. Platinum, silver and gold in ethyl malonate gave velocities of 2.3, 1.7 and 1.4 times  $10^{-6}$  centimeters per volt respectively. Platinum, gold and silver solutions could be prepared only in liquids having a readily replaceable hydrogen (water, ethyl malonate), while lead, bismuth, etc., could be prepared only in liquids having a replaceable hydroxyl group (water, alcohol). From this the author draws the conclusion that the metals enter into a kind of reaction with the liquid as may be typified in the following equations:



and



By slight dissociation of the aggregates, as  $(\text{Pt}_n\overset{-}{\text{H}})$  into  $\text{Pt}_n^+$  and  $\overset{-}{\text{OH}}$ , the phenomenon of migration may be explained. The value of  $v$  being known along with  $K$  the dielectric constant, the



value of  $V$ , the potential between the particle and the liquid, may be determined. The values in different cases range between  $+0.044$  and  $-0.054$  volt and are but slightly influenced by the nature of the solvent. Since the dielectric constant of water is eight times that of ethyl malonate, it follows that the charge involved in the first solvent must be much the greater, *i. e.*, it is the greater the greater the ionizing power of the liquid.

C. A. KRAUS.

**On the Acceleration of Certain Oxidation Reactions by Means of Hydrocyanic Acid.** BY A. S. LOEVENHART. *Ber.* 39, 130-133.—Substances which catalyze the decomposition of hydrogen peroxide likewise accelerate oxidations by means of hydrogen peroxide. Hydrocyanic acid accelerates the decomposition of hydrogen peroxide by means of copper and iron and their salts. Experiments were carried out which show that, correspondingly, hydrocyanic acid accelerates the oxidation of formic acid by means of copper sulphate. The author thinks that the action of the accelerator consists in the formation of cupric cyanide which is easily converted into the cuprous condition. He also points out that it is a fallacy to look upon certain substances, such as hydrocyanic acid, as negative catalyzers, since they may likewise act as accelerators.

C. A. KRAUS. [P]

**Researches in Physical Chemistry, Carried Out in the University of Toronto during the Past Year.** BY W. LASH MILLER. *Trans. Roy. Soc. Canada*, 10, Part I, Sec. III, 25-27.—A brief summary is given of the following investigations:

- (1) The Chromates of Bismuth, by F. B. ALLEN.
- (2) The Rates of the Reactions in Solutions Containing Potassium Iodide, Arsenious Acid and Chromic Acid, by RALPH E. DELURY.
- (3) The Rate of Reaction between Hydrogen Iodide and Iodic Acids, by SAUL DUSHMAN.
- (4) The Reaction between Bromine and *p*-Nitrophenol, by E. L. C. FORSTER.
- (5) The Electrolysis of Acid Solutions of Aniline, by LACHLAN GILCHRIST.
- (6) A Mechanical Model to Illustrate the Gas Laws, by FRANK B. KENRICK.
- (7) The Determination of Phenol, and the Detection, Estimation, and Rate of Formation of Tribromophenolbromide, by S. J. LLOYD.
- (8) The Electrolytic Migration in Solutions of the Weak Acids, by J. W. MCBAIN.
- (9) An Apparatus for the Quantitative Study of the Action of Chemicals on Bacteria at Constant Temperature, by W. LASH MILLER AND J. J. MACKENZIE.

C. A. KRAUS.

**Researches in Physical Chemistry Carried Out in the University of Toronto during the Past Year.** BY W. LASH MILLER. *Trans. Roy. Soc. Canada*, **11**, Part I, Sec. III, 65-66.—The following investigations are briefly summarized:

(1) The Rate of Oxidation of Potassium Iodide by Bromic Acid, by W. C. CLARK.

(2) The Catalytic Action of Chromic Acid on the Oxidation of Potassium Bromide and Iodide by Chloric, Bromic and Iodic Acids, by W. C. CLARK.

(3) The Rate of Oxidation of Arsenious Acid by Chromic Acid, by R. E. DELURY.

(4) The Reactions in Solutions Containing Arsenious Acid, Potassium Iodide, Potassium Bichromate and Sulphuric Acid, by R. E. DELURY.

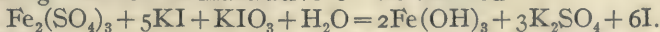
(5) The Action of Ferric Salts on the Oxidation of Ferrous Solutions, and on Catalysis by Ferrous Salts, by W. H. GREEN.

(6) Bibliography of the Literature of Electrolytic Migration, by J. W. MCBAIN.

(7) The Hydrolysis of Sodium Tetrathionate in Alkaline Solutions, by R. B. STEWART. C. A. KRAUS.

**A General Method of Calculation in Kinetics: the Method of Areas. A Method of Approximate Effective Averages.** BY RALPH E. DELURY. *J. Physic. Chem.* **10**, 425-444.—After discussing briefly the methods used in solving the differential equations of chemical kinetics, the author describes two new methods. The first method involves the evaluation of a function by graphical means; in the second method an approximate solution is obtained by introducing a mean function. Further details need not be given here. C. A. KRAUS.

**The Hydrolysis of Salts of Iron, Chromium, Tin, Cobalt, Nickel, and Zinc in the Presence of Iodides and Iodates.** BY SETH E. MOODY. *Am. J. Sci.* **22**, 176-184.—With a view to the iodometric determination of those metals, the action of a mixture of potassium iodide and potassium iodate was determined. The following reaction is illustrative of the method:



All the reactions go on to completion except in the case of zinc where only about 80.13 per cent. of the salt is converted to the base. For details the original should be consulted.

C. A. KRAUS.

**The Electrical Conductivity of Solutions in Liquid Iodine.** BY GILBERT NEWTON LEWIS AND PLUMER WHEELER. *Z. physik. Chem.* **56**, 179-192; *Pr. Am. Acad.* **41**, 417-432.—The conductivities and the conductivity temperature coefficients were determined for solutions of potassium iodide in iodine.

The concentrations ranged between 0.0135 and 28.1 grams of potassium iodide per 100 grams of iodine. The specific conductivity over this range varies between 0.000097 and 0.396 Kohlrausch units. Since the specific gravities of the solutions are not known the specific conductivity may be divided by the number of grams of potassium iodide per 100 grams of solvent. This gives a quantity which is very nearly proportional to the molecular conductivity in dilute solutions. From this it appears that the molecular conductivity of the solutions increases with increasing concentration as a linear function, until a concentration of about 1 gram of salt per 100 grams of solvent is reached. Thereafter the conductivity-concentration ratio reaches a maximum at 5 grams of salt, after which it decreases slowly. The temperature coefficient is  $-0.46$  per cent. at 0.1 gram,  $\pm 0.00$  at 2.8 grams, and  $+0.67$  per cent. at 28.1 grams of salt per 100 grams of solvent. Finally, it was shown that the most carefully prepared iodine has a specific conductivity of  $3 \times 10^{-5}$ . The authors state, however, that this conductivity decreases after remaining in the thermostat some time. The remarkable increase observed in the conductivity with increasing concentration, the authors are inclined to ascribe to the influence of the salt on its own dissociation. The more concentrated solutions thus approach more and more nearly the state of a melted salt. The change in sign of the temperature coefficient is readily explained on this basis.

C. A. KRAUS.

**Galvanic Polarization at a Mercury Cathode.** BY GILBERT NEWTON LEWIS AND RICHARD FAY JACKSON. *Z. physik. Chem.* **56**, 193-211; *Pr. Am. Acad.* **41**, 397-415.—The authors study the polarization of a mercury cathode in a dilute solution of sulphuric acid. By using a large platinum surface saturated with hydrogen as reversible anode and reducing the resistance of the electrolyte to a minimum, potential differences were reduced to such an extent that the fall of potential across the whole cell was almost entirely due to the polarization at the cathode. The polarization was very steady and reached its maximum value shortly after applying the electromotive force. The polarization was, however, a trifle higher in passing from higher to lower than in passing from lower to higher potentials. The polarization electromotive force  $E$  was found to follow very closely the relation  $E = A \log_{10} I + B$ , where  $A$  and  $B$  are constants and  $I$  is the current. The mean value of  $A$  was found to be about 0.160 while  $B$  varied between 0.014 and 0.069. The factors controlling the value of  $B$  could not be determined. The polarization exhibits no discontinuities or singularities as far as 0.7 volt. The authors consider that polarization is not due to the slowness of diffusion of hydrogen ion either to or from the electrode, but rather to some kind of intermediate reaction. As such a reaction



they suggest the change of hydrogen from the monatomic to the diatomic state. For the details of the argument the reader must be referred to the original.

C. A. KRAUS.

**Cornell Meeting of the American Electrochemical Society.**

*Electrochem. Met. Ind.* 4, 211-231.—An Instructive Laboratory Experiment in Applied Electrochemistry. By WILLIAM H. WALKER. Discusses the use of graphical methods in determining the most economical conditions for production as illustrated in the electrolytic production of hypochlorite.

Some Principles of Resistance Furnace Design. By CLARENCE L. COLLINS, 2d.

Electrolytic Density in Storage Cells. By LAMAR LYNDON. Deals with the proper density of the acid to be used in lead plate storage batteries under different conditions.

Electrolytic Corrosion of Structural Steel. By MAXIMILIAN TOCH.

Fused Magnesium Oxide. By H. M. GOODWIN AND R. D. MAILEY. The method of preparation of the fused oxide is described and its physical and chemical properties are determined.

Cathodic Disintegration of Carbon. By GEORGE I. KEMERER.

A New Silicide of Molybdenum. By O. P. WATTS. A silicide, probably of the composition  $\text{MoSi}_2$ , has been prepared in the electric furnace.

Sodium Production. By EDGAR A. ASHCROFT. After discussing the present status of the sodium industry, the author describes a new process of his own.

Laboratory Resistance Furnace. By G. R. WHITE. Describing a cheap resistance furnace.

Electrochemical Processes as Station Load Equalizers. By ELMER A. SPERRY.

Electric Vacuum Furnace. By W. C. ARSEM. A furnace is described with which, it is claimed, a temperature of  $3100^\circ$  may be obtained.

Electrolytic Corrosion of Copper-Tin Alloys. By B. E. CURRY.

Corrosion of Iron by Acids. By C. F. BURGESS. Experiments on the rate of attack for different samples of iron.

Development of the Nickel Plating Industry. By ISAAC ADAMS. Historical sketch.

Lead from Acetate Solutions. By RALPH C. SNOWDON.

Structure of Electrode Deposits. By C. F. BURGESS AND O. P. WATTS.

Cadmium Standard Cell. By G. A. HULETT. Experiments indicate a slow change of electromotive force with the time, which seriously impairs the usefulness of the cell as a primary standard.

Electrodeposition of Bronze. By B. E. CURRY.

Ferromanganese Anodes in Alkaline Solutions. By G. R. WHITE.

Colloids. By H. E. PATTEN. Discusses the Migration of Colloids.

Fused Sodium Peroxide for Regeneration of Air. By GEORGE F. BRINDLEY AND RICHARD VON FOREGGER. The experiments go to show that fused sodium peroxide may be successfully used for regenerating the air in a small enclosed space.

Alternating Current Electrolysis with Cadmium Electrodes. By G. R. WHITE.

Electrolytic Chromium. By MAX LE BLANC. This is a contribution to a discussion which has arisen concerning the possibility of obtaining chromium deposits of any desired thickness.

Free Energy of Various Compounds. By M. DE K. THOMPSON. The author has collected the data enabling him to calculate the free energy of a considerable number of compounds.

Electrolysis of Caustic Soda. By J. W. RICHARDS.

Potential Differences in Aqueous and Non-Aqueous Solutions. By LOUIS KAHLENBERG AND A. S. MCDANIEL. A study of the potential between electrodes of lead peroxide and manganese peroxide and solutions in various non-aqueous solvents.

Silver Coulometer. By H. S. CARHART AND F. W. WILLARD. Perchlorate of silver is used as electrolyte.

Errors in Pyrometry. By E. S. SHEPHERD. A discussion of the errors involved in various methods of pyrometric measurements, in which the author emphasizes the necessity of careful manipulation on the part of the observer. C. A. KRAUS.

R. Threlfall on Electrochemical Theory. *Electrochem. Met. Ind.* 4, 19-20.—Reprint of a portion of the address of R. Threlfall before the (Brit.) Institute of Electrical Engineers.

C. A. KRAUS.

Storage Batteries. *Electrochem. Met. Ind.* 4, 185-186.—Giving extracts from a paper by Rudolf Gahl before the Colorado Scientific Society, in which are pointed out some of the difficulties that remain to be overcome in storage battery manufacture.

C. A. KRAUS.

The Electrochemistry of the Metallic Arc. By ISADOR LADOFF. *Electrochem. Met. Ind.* 3, 303-304, 342-343, 420-421.—This article reviews the literature relating to the metallic arc, including the arc between hot oxides.

C. A. KRAUS.

The Lines of Current in Storage Batteries—An Experimental Study. By M. U. SCHOOP. *Electrochem. Met. Ind.* 4, 268-271, 307-311.—The author shows that by means of two auxiliary electrodes, placed near each other and connected with a millivoltmeter, the equipotential surfaces and conse-

quently the lines of flow of the current in an electrolyte carrying a current may be conveniently investigated. By such means he has investigated the distribution of the current in storage batteries and he shows that many common troubles, such as distortion of the plates, etc., are largely due to an unequal distribution of the current in different parts of the cell. The original should be consulted for details.

C. A. KRAUS.

**The Flow of the Lines of Current in Electrochemical Systems.**

*Electrochem. Met. Ind.* **4**, 292.—An editorial comment on the paper of Schoop's (see above), in which attention is called to the value of studying the lines of flow of the current in electrolytic systems such as electroplating and electrorefining, as well as in electric furnaces.

C. A. KRAUS.

**Action of Acids on Iron and the Use of the Acid Pickle.**

By CHARLES F. BURGESS. *Electrochem. Met. Ind.* **3**, 332-335, 384-386.—The author discusses different aspects of the problem of removing the oxide films from iron and steel by means of acids. The article does not admit of a brief abstract.

C. A. KRAUS.

**Vertical Arc Furnaces for the Laboratory.**

By SAMUEL L. TUCKER. *Electrochem. Met. Ind.* **4**, 263 and 264.—The author describes forms of arc furnaces in the construction of the essential parts of which Acheson graphite is used.

C. A. KRAUS.

**An Electric Furnace for Heating Crucibles.**

By OLIVER P. WATTS. *Electrochem. Met. Ind.* **4**, 273-275.—A furnace is described which may be used for melting such metals as iron and chromium without introducing any considerable amount of impurities. Graphite crucibles, made from graphite cylinders, are embedded in a resistor consisting mainly of carbon. A furnace of this kind, accommodating eight crucibles 3 inches in diameter and  $5\frac{1}{2}$  inches high, can be heated to the necessary temperature with 110 volts and a maximum current of 500 amperes.

C. A. KRAUS.

**Studies in Vapor Composition, IV.**

By H. R. CARVETH AND J. P. MAGNUSSON. *J. Physic. Chem.* **10**, 445-454.—After giving a summary of the different forms of apparatus devised for measuring molecular weights by vapor heating methods, the authors describe a new modification, designed to combine simplicity with ease of manipulation so as to make it suitable for the use of students.

C. A. KRAUS.

**The Variation of the Valency of Elements with Temperature.**

By E. H. ARCHIBALD AND D. McINTOSH. *Trans. Roy. Soc. Canada*, Part I, Sec. III, **10**, 43-46.—The authors consider that the valence of elements increases with decreasing temperature as was suggested by Friedel in connection with the compound



formed between hydrochloric acid and ether. Instead of confining the valence of oxygen to four, they ascribe to it a varying valence as high as twelve. They find that many organic compounds are soluble in the anhydrous liquid halogen acids. From the fact that solution is accompanied by evolution of a considerable amount of heat and that the equivalent conductivity of these solutions increases with increasing concentration, they conclude that compounds are formed. They succeeded in isolating compounds between the acids and a number of ketones, ethers and alcohols. These compounds have definite melting-points which are higher than those of the constituents, and the melting-points are the lower the larger the number of acid molecules combined with a single molecule of the dissolved substance. Assuming that all the acids are combined with the oxygen of the compounds, *i. e.*, assuming that the hydrogen and the halide are separately combined to the oxygen, they deduce the valence of oxygen as varying from 4 to 12, the valence being the higher the lower the melting-point of the compound. They also have results that indicate that nitrogen behaves in a manner similar to

C. A. KRAUS.

**The Absorption of Potassium by Soils.** BY OSWALD SCHREINER AND GEORGE H. FAILYER. *J. Physic. Chem.* **10**, 361-369.—The authors study the relation between the amount of potassium chloride absorbed by, and the amount of solution percolating through, different kinds of soils.

C. A. KRAUS.

## INORGANIC CHEMISTRY.

**On the Chromates of Caesium.** BY FRANK ROY FRAPRIE. *Am. J. Sci.* **21**, 309-317.—The author has prepared the following compounds:  $\text{Cs}_2\text{CrO}_4$   $\alpha$ , (rhombohedral-hemihedral),  $\text{Cs}_2\text{CrO}_4$   $\beta$ , (orthorhombic),  $\text{Cs}_2\text{Cr}_2\text{O}_7$  (triclinic),  $\text{Cs}_2\text{Cr}_3\text{O}_{10}$  (rhombohedral-hemihedral). Careful measurements of the crystals are given. An attempt to obtain the most favorable conditions for the formation of well-developed crystals led to the use of pressures up to 30 atmospheres. The conclusions reached by these pressure tests were that such pressure is not sufficient to produce any measurable difference of crystallographic axes or angles in hexagonal caesium chromate. It seems probable, however, that it effects a change in the habit of the crystals.

LAUDER W. JONES.

**The Solubility of Nitric Oxide and of Air in Sulphuric Acid.** BY O. F. TOWER. *Z. anorg. Chem.* **50**, 382-388.—The amount of nitric oxide which will dissolve in sulphuric acid is of importance because of the practical use of Lunge's nitrometer. Various values have been assigned to this coefficient of solubility. Lunge found the value 0.035 cc. of nitric oxide in 1 cc. of sulphuric acid

(98 per cent.), and 0.017 cc. in 1 cc. of acid (60 per cent.). In Nernst's laboratory the value 0.03 was found. The author employed Bunsen's method, in which a Bunsen eudiometer over mercury was used to hold the gas; the acid was then admitted and the two were shaken together. In this way the author obtained a value 0.0227, but it was observed that the gas volume in contact with the sulphuric acid (98 per cent.) in the eudiometer became slowly smaller, sometimes during a period of eight days. At the same time, mercury dissolved in the concentrated acid and an odor of sulphur dioxide was perceptible. The values obtained varied from 0.0227 to 0.147. Concentrated sulphuric acid, therefore, should not be used in Lunge's method. With a somewhat more dilute acid, 90 per cent. or less, these difficulties did not arise. The average values given for acid of the various strengths indicated, and at 760 mm. pressure (calculated) are as follows:

Concentration of the acid. Per cent.	Coefficient of solubility 18° and 760 mm. (Average).
90	0.0193
80	0.0117
70	0.0113
60	0.0118
50	0.0120

Similar experiments with air showed that the solubility of air in 98 per cent. sulphuric acid, unlike that of nitric oxide, was constant. The following values are given:

Concentration of acid. Per cent.	Coefficient of solubility. 18° and 760 mm.
98	0.0173
90	0.0107
80	0.0069
70	0.0055
60	0.0059
50	0.0076

For air there is a minimum at 70 per cent.; there is also a doubtful minimum at 70 per cent. acid for nitric acid. From these results it follows that in the determination of nitrites, nitrates and oxides of nitrogen by Lunge's method, the solubility of nitric oxide in sulphuric acid of 90 per cent. concentration is so slight that it may be disregarded, if not more than 10 cc. of acid are used. Sulphuric acid of 70 per cent. strength is preferable for the determination.

LAUDER W. JONES.

**On the Constitution of Amalgams.** BY GEORGE MCPHAIL SMITH. *Am. Ch. J.* 36, 124-135.—The paper presents a critical discussion of the important views and investigations concerning the nature of liquid amalgams, especially alkali amalgams, with the object of determining whether the evidence at hand is not sufficient to show that such amalgams, in many cases, may contain definite compounds, as well as mere solutions; such a con-

dition has been established in the case of solid amalgams. The various results obtained by Ramsay, Heycock and Neville, Tammann and Meyer, as well as other investigators, are discussed and the following conclusions are given by the author:

(1) The methods of molecular weight determination employed do not furnish a means of deciding whether in an amalgam, or alloy, the dissolved metal is present as such, or is in combination with the solvent.

(2) There is every evidence of the existence of many definite chemical compounds of mercury with metals of the alkali and alkaline earth groups, and there is no reason to suppose that these compounds break up on being dissolved in mercury. The liquid amalgams of the metals of these two groups are solutions in mercury of compounds of the general formula  $MHg_m$ .

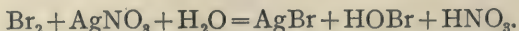
(3) In those cases in which we have good evidence of the non-existence of compounds of mercury with the dissolved metals, we are justified in concluding that the metals are dissolved as such in mercury. This is the case with zinc, cadmium, bismuth, lead, tin; and, according to Ramsay, these metals exist, when dissolved in mercury, in the form of monatomic molecules.

LAUDER W. JONES.

**A Method of Determining Hydrogen Peroxide and Ferrous Salt and Other Reducing Agents.** BY W. E. MATHEWSON AND J. C. CALVIN. *Am. Ch. J.* **36**, 113-117.—The method is based upon the use of standardized hydrogen peroxide as an oxidizing agent with a soluble titanium salt, *e. g.*, titanium potassium sulphate, as an indicator. The deep yellow color which hydrogen peroxide yields with titanium compounds serves as a means of determining the end-point in the titration. In this way solutions of ferrous ammonium sulphate were successfully titrated, while solutions of sodium nitrate were found to yield fairly good results, but somewhat too high in value. It is suggested that many other reactions, not only oxidizing but reducing actions as well, in which hydrogen peroxide enters as a reagent, could be determined in a similar manner.

LAUDER W. JONES.

**The Existence of Bromous Acid.** BY A. H. RICHARDS. *J. Chem. Ind.* January 15, 1906.—If silver nitrate in excess is added to a cold solution of bromine in water, the following reaction occurs:



If, however, liquid bromine is added in excess to a concentrated solution of silver nitrate, the reaction is quite different. In several ways the oxidizing value of such a solution, after the complete removal of the excess of bromine, gave as a ratio

$$\text{O} : \text{Br} = 0.1499 : 0.3745.$$



This seems to indicate the presence of a bromine compound in which the ratio of oxygen to bromine is two to one, and leads the author to assume the presence of bromous acid,  $\text{HBrO}_2$ , in the solution. LAUDER W. JONES.

**The Relative Solubilities of Some Difficultly Soluble Calcium and Barium Salts.** BY H. W. FOOTE AND G. A. MENGE. *Am. Ch. J.* 35, 432-445.—The authors determine the relative solubilities of calcium and barium carbonates, of calcium and barium oxalates, and of calcium and barium fluorides. The method employed consisted in treating the difficultly soluble calcium salt with a solution of barium chloride of known concentration, and the corresponding barium salt with an equivalent solution of calcium chloride. The mixtures were shaken until no further action occurred as determined by analysis. Then the proportions of barium and calcium in the solutions were found, and the relative solubilities were calculated. In the case of the carbonates a consideration of the solubility products of the difficultly soluble salts, and an assumption of the complete hydrolysis of the carbonates in solution leads to the following equation:

$$\frac{\text{CaCO}_3}{\text{BaCO}_3} = \frac{\sqrt[3]{K_1}}{\sqrt[3]{K_2}} = \sqrt[3]{\frac{\text{CaCl}_2}{\text{BaCl}_2}}.$$

$K_1$  and  $K_2$  are the respective solubility products in the hydrolyzed solutions. The possibility of the formation of mixed crystals in the precipitate was also considered and tested experimentally. As an average value for the relative solubility of calcium and barium carbonates, the authors give the number 1.15. In the case of the oxalates, the hydrolysis was neglected, and the following equation was arrived at:

$$\frac{\text{CaC}_2\text{O}_4}{\text{BaC}_2\text{O}_4} = \frac{\sqrt{K_1}}{\sqrt{K_2}} = \sqrt{\frac{\text{CaCl}_2}{\text{BaCl}_2}}.$$

$$\text{The relative solubility} = \frac{\text{CaC}_2\text{O}_4}{\text{BaC}_2\text{O}_4} = 0.22.$$

The relative solubility in the case of the fluorides could not be determined with sufficient accuracy. The authors compare their values with those found by using the solubilities of these salts obtained by the method of electrical conductivity by Rose and Kohlrausch.

	Solubility in mg. eq. per liter.	Ca/Ba (Kohlrausch).	Ca/Ba.
$\text{CaCO}_3$	0.26		
$\text{BaCO}_3$	0.24	1.08	1.15
$\text{CaC}_2\text{O}_4$	0.087		
$\text{BaC}_2\text{O}_4$	0.76	0.11	0.22

LAUDER W. JONES.

## MINERALOGICAL AND GEOLOGICAL CHEMISTRY.

**Analcite-Trachyte Tuffs and Breccias from Southwest Alberta, Canada.** By C. W. KNIGHT. *Canadian Record Sci.*, 9, 265-278; figures.—In southwest Alberta, about 12 miles east of the boundary of British Columbia and 50 north of the international boundary, occur tuffs and breccias having the mineralogical and chemical composition of trachyte in which analcite is a primary constituent. To the new pyroclastic rock type the name blairmorite (phlegrose in the quantitative system of classification) is given. The author gives an analysis of the not quite pure analcite and another by C. W. Dickson of the blairmorite itself. Three other rock types are briefly described, augite-trachyte, andesite and tinguaita.

W. F. HILLEBRAND.

**Report of the Bureau of Mines [[Ontario], 1905.** Vol. 14, Part I, 374 pp.; map, numerous illustrations and figures.—This volume contains the following reports by various authors: Statistical Review, Summer Mining Classes, Mines of Western Ontario, Mines of Eastern Ontario, Petroleum and Natural Gas, Cement Industry of Ontario, Explorations in Abitibi, Agricultural Resources of Abitibi (containing chemical and physical analyses of soils), Loon Lake Iron-bearing District, Boston Township Iron Range, Precambrian Nomenclature, Iron Ranges of Michipicoten West.

W. F. HILLEBRAND.

**The Limestone Resources and the Lime Industry in Ohio.** By EDWARD ORTON, JR., AND S. V. PEPPEL. *Geol. Survey Ohio Bull.* 4, 361 pp.; figures. **The Manufacture of Artificial Sandstone or Sand-Lime Brick.** By S. V. PEPPEL. *Geol. Survey Ohio, Bull.* 5, 79 pp.; figures.—These two reports have appeared bound in one volume without indexes, though with full tables of contents. The first report contains chapters on the occurrence, extent and classification of the Ohio limestones; methods of sampling and testing; composition by counties with special reference to fitness for Portland cement manufacture; composition, physical character and uses considered by geological formations; uses; technology. Very many analyses supplement and illustrate the text. The second report was belated and represents the condition of the industry only to 1903.

W. F. HILLEBRAND.

**Schistosity by Crystallization; A Qualitative Proof.** By FRED. EUGENE WRIGHT. *Am. J. Sci.* 22, 224-230; figures.—Preliminary experiments are described which confirm theoretical deductions by other writers that the schistosity of many metamorphic rocks may be due to recrystallization under the influence of unequal stress.

W. F. HILLEBRAND.

**The Tin Deposits of the Kinta Valley, Federated Malay States.** BY WILLIAM R. RUMBOLD. *Bi-monthly Bull. Am. Inst. Min. Eng.* September, 1906, pp. 755-765; figures.—The tin deposits of this valley, in the state of Perak, are found both in the intrusive granite of the bordering mountains and in the much folded limestone that lies between as well as in the alluvium that covers the valley and its slopes. The author regards it as certain that the limestone itself contains lode deposits, and three of these he describes. Their origin is ascribed to ascending waters connected with pneumatolytic after-actions of the eruptive granite. In the alluvial deposits, which are very variable in character, the tin may occur in a sandy material or in a thick, heavy clay. It is usually found in small black crystals mixed with tourmaline, ilmenite, magnetite, pyrite, wolframite, garnet, zircon, spinel, corundum, and in one case cerussite. Most of these accompanying minerals occur more abundantly near the granite contact. In the red clay deposits the association is with iron oxide to the exclusion, generally, of the other minerals named.

W. F. HILLEBRAND.

**The Production of Iron Ores in 1905.** BY JOHN BIRKINBINE. *U. S. Geol. Survey, Advance Chapter Min. Resources U. S. 1905*, 38 pp.—This report contains the usual tables of cargo analyses of Lake Superior iron ores, besides others of ores from Shady Valley, Tennessee, Polk County, Georgia, and Puerto Principe, Cuba.

W. F. HILLEBRAND.

**Montana Coal and Lignite Deposits.** BY J. P. ROWE. *Univ. Montana Bull.* 37, 82 pp.; map, plates, figures.—In this bulletin is gathered together a large amount of information relating to the geology of the coal fields of Montana, the deposits considered by counties, the composition of the coals as determined by proximate analysis, calorific values, heating efficiency and present and future uses.

W. F. HILLEBRAND.

**The Genesis of Thermal Waters and Their Connection with Volcanism.** BY ARMAND GAUTIER. *Econ. Geol.* 1, 688-697.—This is a free and condensed translation by F. L. Ransome of the important original paper, which appeared in the *Annales des Mines*, 9, 316-370 (1906). Space does not permit the presentation of a satisfactory abstract.

W. F. HILLEBRAND.

**Geology and Mineral Resources of Mississippi.** BY A. F. CRIDER. *U. S. Geol. Survey Bull.* 283, 99 pp.; map, plates.—For the past few years the value of the mineral production of Mississippi has varied between \$500,000 and \$700,000 annually. The clay-working industries yield about nine-tenths of this production, next in importance to which are the mineral waters.



The report contains many new analyses of clays and limestones, besides a few of lignites, etc.

W. F. HILLEBRAND.

**Geology and Underground Water Resources of Northern Louisiana and Southern Arkansas.** BY A. C. VEATCH. *U. S. Geol. Survey, Professional Paper 46*, 422 pp.; maps, plates.—Chapter 5 of this report contains much chemical matter from different sources relating to the character and composition of well and spring waters from the region surveyed.

W. F. HILLEBRAND.



**An Ontario Lead Deposit.** BY J. VOLNEY LEWIS. *Economic Geology*, **1**, 682–687.—A galena-calcite vein two to seven feet wide in siliceous schist in Hastings County, Ontario, Canada. Marcasite, siderite, sphalerite, pyrrhotite, and pyrite also occur, as well as a paraffin. There is no selvage, and the vein adheres firmly to the walls. The proportion of galena is highest where the fissure is widest. Quartz and silicates are absent, as are also gold and silver although the surrounding region contains numerous auriferous veins. The indication is that both the minerals and the waters by which they were deposited were derived from the adjacent sediments.

E. C. SULLIVAN.

**Origin and Occurrence of Certain Iron Ores of Northeastern Kentucky.** BY W. C. PHALEN. *Economic Geology*, **1**, 660–673.—These ferrous carbonate deposits, associated with limestone, “have heretofore been regarded as replacements of limestone by ferruginous solutions derived from overlying sediments.” The author points out that the beds of fire-clay that overlie these ores are of doubtful permeability and furthermore contain no iron carbonate, as they would if solutions of that substance had passed through them. The conclusion is reached that the iron ore was deposited before the clay.

E. C. SULLIVAN.

**Sketch of the Geology and Ore Deposits of the Cochise Mining District, Cochise County, Arizona.** BY L. O. KELLOGG. *Economic Geology*, **1**, 651–659.—The district affords copper and some wolframite. All the formations are traversed by quartz veins, which in the granite may carry wolframite and in the other formations (mica schist, limestone, quartzite) are usually barren, though a few carry chalcocite. Wolframite occurs also in placers. The most extensive deposits of copper are replacements in limestone. Most of the copper minerals are represented in the ores. Chalcopyrite, bornite, malachite and chalcocite are most abundant. In some cases, especially in the garnet zones in the lower part of the limestone, considerable zinc blende is found also. The commonest gangue minerals are garnet, quartz and calcite. The growth and alteration of the ore were studied by means of a metallographic microscope. Bornite appears pink, and it is the

alternation of this with its blue decomposition product that gives the typical iridescent effect; this would suggest that most bornite is in process of alteration. It is probable that the intrusion of the granite brought with it the materials necessary to form the sulphides and part of the gangue in the ore, which were deposited by reaction with the limestone. Surface waters have brought about secondary enrichment.  E. C. SULLIVAN. 

**Experiments on the Solution, Transportation, and Deposition of Copper, Silver, and Gold.** BY H. N. STOKES. *Economic Geology*, **1**, 644-650.—The apparatus used was a bent glass tube, the lower limb of which was heated to 200° while the upper was cooled by a water-jacket. A solution of ferrous sulphate and cupric sulphate gave metallic copper in the cold limb, ferric oxide in the hot. Pyrite with 10 per cent. cupric sulphate gave copper in the cold limb and a substance colored like bornite in the hot. Chalcocite was readily decomposed by cupric sulphate with deposition of copper in the cold region. Covellite similarly treated was not affected. Siderite with cupric sulphate gave metallic copper in both limbs, and hematite and malachite in the lower limb. Hornblende with cupric sulphate gave copper in the upper limb and hematite in the lower. Metallic silver was dissolved and redeposited in the cold limb by acidified cupric sulphate and ferric alum solutions. Gold gave similar results with cupric and ferric chlorides; it was not dissolved by the sulphates.

E. C. SULLIVAN.

**Los Pilares Mine, Nacozari, Mexico.** BY SAMUEL FRANKLIN EMMONS. *Economic Geology*, **1**, 629-643.—The rock which forms the mass of Pilares Mountain is either a quartz monzonite intrusive in an andesite breccia or possibly a highly altered and silicified variety of the same andesite. A large proportion of the rock fragments "resemble a mass of broken potsherds, being relatively thin, often curved and shell-shaped;" this may be the result of simultaneous shock in two directions. The shattering of the rock mass was accompanied or followed by the introduction of silica and metallic sulphides that cemented the fragments into a breccia. The ore, which is worked for copper, is essentially a breccia of which pyrite, chalcopyrite and quartz constitute the cementing material. It contains traces of gold and silver, possibly a small amount of arsenic, and in some places a little zinc. Secondary minerals are bornite and chalcocite, the former apparently in larger proportion. "In the gossan, as is often the case in arid regions, the limonite is almost entirely altered to specular iron."

E. C. SULLIVAN.

**On the Origin and Relations of the Nickel and Copper Deposits of Sudbury, Ontario, Canada.** BY ALFRED ERNEST

BARLOW (Second Paper). (See this Journal, 28, R 363.) *Economic Geology*, 1, 545-553.—The nickel occurs chiefly as pentlandite,  $(\text{Ni} + \text{Fe})\text{S}$ , associated with pyrrhotite, chalcopyrite being found in much smaller amounts. The nickel-copper ratio varies from 5.4-8.1:0.5-0.8 in selected specimens of nickel ore to 1.3-2.5:13.9-15.7 in hand-picked chalcopyrite (the figures show the percentage range), and from 1:3 to (more commonly) 2:1 in average ore carrying up to 5.50 per cent. nickel. The cobalt-nickel ratio is 1:40 or 50. Matte with 80 per cent. nickel + copper contains 0.10 to 0.20 ounce gold, 2.5 to 5.3 ounces silver, and 0.4 ounce platinum metals per ton. The ore occurs at the outer edge of an immense intrusive sheet of hypersthene gabbro or norite or in connection with smaller masses of the same rock. The deposits have no well-defined boundary walls but extend into and impregnate the enclosing rock. E. C. SULLIVAN.

**Quartz Glass.** BY ARTHUR L. DAY AND E. S. SHEPHERD. *Science*, 23, 670-672.—Quartz glass has several properties which make it valuable in chemical and physical laboratories. (1) It expands less than one-tenth as much as ordinary glass when heated. (2) It can be heated to  $1000^{\circ}$  without softening. (3) It transmits ultra-violet light freely. The chief difficulties encountered in making quartz glass are those which arise from the fact that quartz has no sharp melting-point, and does not at any temperature, when pure, form a thin liquid. Quartz vaporizes freely at the temperature of melting platinum, while it is still much too viscous to release the enclosed bubbles of air. When pure crystallized silica, either quartz or tridymite, is fused in a graphite crucible, heated by an alternating current, no difficulty is experienced in obtaining quartz glass, but it is hard to remove the air bubbles. If the temperature is too high ( $2500^{\circ}$ ), the glass still contains air bubbles, and is discolored by some reduced silica. After many attempts, the most successful method seemed to be, to heat a charge rapidly to a high temperature ( $2000^{\circ}$ ) until the quartz commenced to volatilize freely. The quartz vapor expels a large part of the air. Then a pressure of 500 pounds was applied, and the temperature was reduced to  $1800^{\circ}$ . Time was allowed for the quartz to flow together without being attacked by the graphite. In this way plates of quartz glass  $3 \times 5 \times \frac{1}{2}$  inches were obtained almost free from air bubbles, and only very slightly discolored by silicon. The bubbles were small (0.5 mm.) and not over two or three to a cubic centimeter.

LAUDER W. JONES.

**Thorium Nitrate.** *Eng. Min. J.* 81, 1228.—In January ('06) the Thorium Convention in Germany decided to kill competition in thorium nitrate by suddenly dropping the price to \$6.43 per kg. (less 3 per cent. discount). In 1894, thorium nitrate



sold for \$4.76 per kg. From 1904-1906, for \$12.61 per kg. It is suggested by the author that the Thorium Convention has probably made a mistake, since attention has been called to the supplies of thorium and cerium for mantles which can be obtained chiefly in Brazil and the Carolinas. A new industry may be established with such firm foundation that it may deprive Germany of its present predominance in the incandescent gas-mantle industry and the subsidiary chemical industries.

LAUDER W. JONES.

**Further Work on the Interaction of Hydrochloric Acid and Potassium Permanganate in the Presence of Various Inorganic Salts.** BY JAMES BROWN. *Am. J. Sci.* **21**, 41-57.—The effects attributed by Wagner to the catalytic action of ferric chloride in the reaction between hydrochloric acid and potassium permanganate is accounted for by the oxidation of oxalic acid used in titration by chlorine which is liberated during the process (previous paper, *Am. J. Sci.* **19**, 31). Continued study of the chlorides of chromium, cadmium, gold and platinum has shown that in the case of gold and cadmium the so-called "catalytic effect" of Wagner is to be accounted for by chlorine retained in the solution, while in the case of platinum and chromium the observed differences are mostly explained by chlorine retained in solution, but partially by an excessive reduction of potassium permanganate not yet accounted for.

LAUDER W. JONES.

**Studies on Fluorite.** BY HARRY W. MORSE. *Pr. Am. Acad. Arts. Sci.* **41**, No. 27.—The first part of the paper reviews the present conception of fluorescence in gases, liquids and solids. This paper contains also a summary of the spectroscopic results obtained during a study of fluorite with respect to the fluorescence, or the light emitted by fluorite when the exciting source is light. Many photographic plates are given and certain conclusions drawn. In a second part of this paper, a study of the thermo-luminescence is presented. A third part deals with the gases and liquids enclosed in fluorite.

LAUDER W. JONES.

**A Study in Crystallization.** BY JAMES H. BOWMAN. *J. Chem. Ind.* February 28, 1906.—The article presents some interesting results obtained by allowing certain fused or dissolved substances to crystallize in the presence of various colloidal materials. The presence of such colloids will produce, in general, one or more of the following results: (a) Total prevention of crystallization; (b) suppression of some of the natural modes of crystalline growth; (c) extension of crystals to abnormal proportions, causing them to become compound crystals; (d) bending, gyrating and curving of the parts. Many interesting illustrations of these various changes are given.

LAUDER W. JONES.

**A Revision of the Atomic Weight of Bromine.** BY GREGORY P. BAXTER. *Pr. Am. Acad. Arts Sci.* 42, No. 11.—After a discussion of the previous methods used to determine the atomic weight of bromine, the author arrives at the conclusion that the most probable value must lie between 79.95 and 79.96.  
(Ag = 107.93; Cl = 35.473).

Two methods were employed by the author: first, the synthesis of silver bromide from pure silver and pure bromine; second, the conversion of silver bromide into silver chloride. As a result of eighteen determinations made by the precipitation of silver bromide from silver nitrate and ammonium bromide, the value obtained was 79.953. Different samples of pure silver and pure bromine were used in some of the determinations. An average of thirteen experiments by the second method gave the value 79.952. The author chooses as most probable value 79.953.  
LAUDER W. JONES.

**The Application of Metallography to Opaque Minerals.** BY WILLIAM CAMPBELL. *School Mines Quart.* 27, 414-422.—The author considers the application of metallography to the study of mineral surfaces and suggests a probable wide application. The preparation of samples, the development of structure, the apparatus necessary are all essentially the same as for metals. No advantages over regular petrographic work are offered. The paper is illustrated by two examples, decomposing chalcopyrite, and an ore containing pyrite, bornite and chalcocite.

HENRY FAY.

**A New Occurrence of Vanadium in Peru.** BY FOSTER HEWITT. *Eng. Min. J.* September 1, 1906, p. 385.—Description of a new mine near Cerro de Pasco, Peru. The vanadium mineral is dark green, streak greenish-black, hardness 3.5, sp. gr. 2.65. Analysis:  $\text{SiO}_2$ , 10.88 per cent.;  $\text{Al}_2\text{O}_3$ , 3.85; Fe, 2.45; V, 16.08; S, 54.06;  $\text{MoO}_3$ , 0.50; S (soluble in  $\text{CS}_2$ ), 6.55. The material is a mixture. Asphaltite occurs at the same place, running 9.5 to 15.7 per cent. of vanadium; also an intermediate mineral. There are 400 feet of outcrop, and several hundred tons of high vanadium ore have been already shipped.  
J. W. RICHARDS.

**Production and Uses of Canadian Chrome Ore.** BY W. H. EDWARDS. *Eng. Min. J.* September 29, 1906, p. 584.—Almost all the product is shipped to the United States, 80,000 tons per year. It is found in large quantities in the serpentine belt in the eastern part of Quebec. The concentrated ore runs 50 to 54 per cent.  $\text{Cr}_2\text{O}_3$ .  
J. W. RICHARDS.

## ANALYTICAL CHEMISTRY.

**A New Colorimeter for the Determination of Carbon in Steel.** BY C. W. WHITE. *Bull. Am. Inst. Min. Eng.* **11**, 743 (1906).—In this colorimeter equal amounts of the standard and of the unknown steel in equal volumes of the solvent are compared in hollow glass wedges which may be moved up and down in front of a horizontal slit. A clever combination of mirrors brings the light from one wedge on either side of the light from the other wedge. Connected to each wedge is a scale which measures distances from the sharp edge of the wedge to the slit. These distances are proportional to the thickness of the wedge at the slit. This instrument is easily cleaned, the comparisons may be made rapidly, and the accuracy is certainly as great as is required for any colorimetric method for carbon in steel.

L. F. HAWLEY.

**Variable Sensitiveness in Colorimetry.** BY D. W. HORN AND SUE A. BLAKE. *Am. Chem. J.* **36**, 195 (1906).—In the colorimetric determination of copper sulphate solutions the sensitiveness is found to increase with decreasing concentration until very dilute, almost colorless solutions are reached, when the sensitiveness decreases. A more complicated relation between sensitiveness and concentration is found in the case of potassium chromate solutions, there being two points of maximum sensitiveness. Assuming that similar relations hold in general in the field of colorimetry the authors discuss the difference in the percentage error which may be caused by using different concentrations.

L. F. HAWLEY.

**On a New Method for the Preparation of Standard Solutions.** BY S. F. ACREE AND S. F. BRUNEL. *Am. Chem. J.* **36**, 113.—The methods given are for the preparation of solutions of soluble gases such as hydrochloric acid, ammonia, etc., and consist in dissolving the gas in the required amount of water. The object of the method is to save time and to gain greater accuracy over the ordinary methods, especially for physico-chemical work where an accuracy of at least 0.05 per cent. is required. The method for hydrochloric acid is briefly as follows: A clean liter flask is nearly filled with conductivity water at room temperature and is closed with a one-hole rubber stopper, through which passes a glass tube drawn out into a long capillary which reaches nearly to the bottom of the flask. The flask is carefully weighed with a similar liter flask on the other pan. Hydrochloric acid gas, generated from pure ammonium chloride and sulphuric acid, washed by sulphuric acid in two Wetzel wash-bottles, is run into the flask until the increase in weight is a little more than a gram-



molecule. The excess of water required is then run in through a burette. (Essentially the same method was proposed by G. T. Moody: *J. Chem. Soc.* **73**, 658.) This solution is accurate to 0.01 per cent., and is practically free from carbon dioxide, silicates and other impurities common to "C. P." hydrochloric acid. The method is adapted to any dry gas such as HI, H<sub>2</sub>S, SO<sub>2</sub>, NH<sub>3</sub>, Cl, etc. A method for determining the strength of hydrochloric acid, sulphuric acid and the hydroxides of sodium and potassium is also given and the authors claim superiority for it over the methods of silver chloride and barium sulphate. It consists in evaporating to dryness the solutions of the acids neutralized with twice crystallized NaHCO<sub>3</sub> and weighing the sodium salt in a platinum dish. The hydroxides may be neutralized by standard hydrochloric acid and treated in the same way.

G. C. ROBERTSON.

**Elimination and Alkalimetric Estimation of Silicon Fluoride in Analysis of Fluorides.** BY ALBERT HILEMAN. *Am. J. Sci.* [4] **22**, 329.—In the determination of fluorine by elimination as silicon tetrafluoride and titration with alkali after absorption in water or alcoholic potassium chloride errors readily occur in both the titration and elimination processes. In the discussion of the different methods of absorption and titration the author gives the results obtained by titrating known amounts of fluosilicic acid in both aqueous and alcoholic solutions with each of the three alkalis, sodium, ammonium and potassium hydroxides. Preference seems to be given to the method of titrating in aqueous solution with potassium hydroxide until the potassium fluosilicate is completely hydrolyzed. The errors in the elimination process were found to be (1) incomplete elimination of the silicon tetrafluoride due to insufficient heating, and (2) the carrying over of sulphuric acid into the absorption apparatus. To eliminate these two errors an apparatus was devised in which the sulphuric acid could be boiled and complete decomposition of the fluoride accomplished without any sulphuric acid passing into the absorption tube. In this apparatus twelve runs were made with an average error of 0.0008 gram in amounts of fluorine from 0.1356 to 0.1459 gram.

L. F. HAWLEY.

**The Volumetric Estimation of Antimony.** BY JAMES DARROCH. *Chem. Eng.* **4**, 162-165.—In determining antimony by the iodide method the results cannot be relied upon, for the sodium thiosulphate is decomposed by the strongly acid solution which must be employed. By substituting a standard solution of stannous chloride for the thiosulphate, the method becomes more accurate than the gravimetric methods usually employed and is nearly as rapid as the dry assay. The process is as follows: Heat from 0.5 to 1 gram of the powdered ore with concentrated

hydrochloric acid and a few crystals of tartaric acid until decomposition is complete. Dilute to about 300 cc. and saturate the solution with hydrogen sulphide. Filter off the precipitate and insoluble matter and wash with hydrogen sulphide water. Filtration and washing should be rapid to prevent the decomposition of the antimony sulphide. Puncture the filter-paper, wash the precipitate into a flask, add about 100 cc. of concentrated hydrochloric acid and sufficient potassium chlorate to convert the antimonous chloride into antimonic chloride and boil until the sulphide is dissolved and free chlorine is expelled. Cool, add about 5 grams of potassium iodide and titrate the iodine liberated with the stannous chloride solution. When the iodine color becomes faint; add fresh starch solution and titrate until the solution is colorless. Since copper and arsenic also liberate iodine, and since bismuth iodide resembles free iodine in color, these substances must be absent from the solution before the potassium iodide is added.

B. S. CUSHMAN.

**On Sulphate and Sulphur Determinations.** BY S. F. ACREE. *J. Biol. Chem.* 2, 135-144.—Barium sulphate is very easily reduced to barium sulphide, and the amount may often be half the theoretical value. Several evaporations with  $H_2SO_4$  may be necessary to change barium sulphide into barium sulphate. A new method given here for standardizing hydrochloric acid, sulphuric acid, alkalis and alkali carbonates gives very accurate results. The titration method of Wildenstein for sulphates or for barium yields fairly accurate results. The method for the estimation of calcium, and of sulphates, involving the precipitation of calcium sulphate from alcoholic solutions gives fairly accurate results.

F. P. UNDERHILL.

**The Determination of Water in Mixed Paints.** BY C. D. HOLLY. *Chem. Eng.* 4, 159-161.—In the analysis of mixed paints which is being carried on under the provisions of the North Dakota Paint Law, a well-known brand of paint was found to contain upwards of 20 per cent. of water. The analysis was reported to the manufacturers and in reply the statement was made that the water was not present in the paint as such but that it was derived from a series of compounds, containing hydroxyl groups, produced in the linseed oil by a special process to which it had been subjected. To avoid such criticism on the part of manufacturers, a can of paint was obtained in which the pigment had settled out, the clear oil was siphoned off and the remaining paste was thoroughly stirred. A weighed portion of this paste was allowed to stand, with frequent stirring, in contact with about 3 grams of strip gelatin for twenty-four hours. The gelatin was then removed, washed free of the paint with petroleum ether, pressed between sheets of filter-paper and weighed. After

correcting for the probable equilibrium established between the water absorbed in the gelatin and that in the fluid portion of the paste the water was calculated as 22.4 per cent. A weighed portion of the clear oil, subjected to similar treatment with gelatin, showed only a fraction of 1 per cent. of water. On mixing a portion of the paste with sublimed lead until the mass ceased to be sticky and distilling over an oil-bath, the paint showed 26 per cent. of water. The clear oil, when distilled with sublimed lead, yielded only a fraction of 1 per cent. of water. This proved that no such compound existed in the oil as was claimed by the manufacturers and a careful examination of an aqueous extract obtained from the pigment proved the presence of glue, sodium carbonate, borax and acetate of lead in considerable quantities. These substances could carry a large amount of water into a paint without an undue thickening of the product or causing difficulty in the subsequent thinning with oil. B. S. CUSHMAN.

**On the Resin Content of India Rubber.** BY LYMAN M. BOURNE. *Chem. Eng.* 4, 166-168.—The commercial value of crude India rubber cannot always be judged by the resin content, but of two samples of the same kind of rubber that containing the smaller amount of resin will produce the better compound when vulcanized. The resin content of almost every kind of crude rubber has increased during the past two or three years as is proved by a long series of results given by the author. The method of analysis was as follows: Two or 3 grams of the sample, in small pieces, were dissolved in benzene and the India rubber was precipitated by ethyl alcohol. The mixture of alcohol and benzene was then decanted through a silk filter and the precipitate was washed several times with alcohol. The filtrate, containing the resin, was evaporated to dryness in a weighed flask on a water-bath and dried, as was also the precipitated rubber, in a vacuum at 80° for two hours. B. S. CUSHMAN.

**The Chemical Analysis of Gelatine Dynamites.** BY T. B. STILLMAN AND P. T. AUSTEN. *Chem. Eng.* 4, 95.—Gelatine dynamites are rapidly replacing ordinary dynamite for blasting purposes, since the pyroxylin which they contain renders the dynamite less absorbent of moisture and permits of a reduction of the percentage of nitroglycerol by the substitution of pyroxylin, without material change in the explosive force of the dynamite. The addition of other ingredients such as resin, paraffin, sulphur, wood-pulp, etc., which are to be found in the later forms of gelatin dynamites, complicates the chemical analysis. The authors have obtained fairly concordant and exact results by the use of the following scheme of analysis: Moisture is determined by drying 10 grams of thinly sliced dynamite over calcium chloride. Digestion of the dried material for two hours in a



closed flask with a cold mixture of one part absolute alcohol and two parts anhydrous ether, permits the separation of wood-pulp, sulphur and the nitrates of the alkalies, all of which are nearly insoluble. From the residue insoluble in ether-alcohol, the nitrates are extracted with hot water. Digestion with pure carbon disulphide dissolves the sulphur, and the residue is wood-pulp. The ether-alcohol solution is evaporated to about 100 cc. without the application of heat. An equal volume of chloroform is added with stirring. Soluble nitrocelluloses are thus precipitated, filtered on a weighed filter, washed with chloroform, dried at 60° and weighed as pyroxylin. The filtrate is evaporated over calcium chloride with slight exhaust until the weight is constant. This gives the combined weight of nitroglycerol, resin and paraffin, together with some sulphur and nitrates dissolved by the ether-alcohol. Cold water is added which dissolves the nitrates. The aqueous solution is decanted and evaporated to dryness. This process is repeated as long as nitrates are extracted. The solution left after the extraction of the nitrates, is titrated with normal alcoholic caustic potash solution. This gives the resin (combining weight 330). An excess of normal alcoholic caustic potash is added and the solution evaporated nearly to dryness. The residue is dissolved in water and the paraffin extracted in a separatory funnel by means of ether. In the aqueous solution, sulphur is oxidized with bromine. Hydrochloric acid is added and the precipitated resin filtered off, dried and weighed. The filtrate is boiled and the sulphur precipitated and weighed in the usual way as barium sulphate. The nitroglycerol is obtained by difference. In case camphor is present, it is weighed with the resin acids; gentle heating will volatilize the camphor and leave the resin acids.

T. G. DELBRIDGE.

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## METALLURGICAL CHEMISTRY.

**Metallurgical Calculations: Conduction and Radiation of Heat.** BY J. W. RICHARDS. *Electrochem. Met. Ind.* March, 1906.—A discussion of the principles of heat conduction, tables of conductivity of metals and refractory materials and of heat transfer from gases to solids; with problems concerning cooling of gases in fire-brick lined and unlined tubes and air cooling of metal surfaces.

J. W. RICHARDS.

**The Use of Pyrometers in Ore-Roasting.** BY WM. E. GREENAWALT. *Eng. Min. J.* August 4, 1906.—Pyrometers cannot replace intelligent labor, but they are useful as supplementing it, and are indispensable with inexperienced labor. They are of most service in determining the temperature beyond which it is unsafe to roast. An inexperienced man will overheat the ore,

thinking to hasten the roasting, but usually making sulphur too high; the use of the pyrometer prevents this overheating. From 775 to 890° (1400–1600° F.) is the usual range in the hottest part of the furnace, 935° (1700° F.) is rarely exceeded, and some ores give best results at 650° (1200° F.). The Le Chatelier couple is the most satisfactory; if properly protected, it may be left permanently in the furnace.

J. W. RICHARDS.

**Clay-Lined Crucibles.** *Brass World*, July, 1906, pp. 231–232.—For making low carbon steel in crucibles, clay crucibles have been extensively used abroad, but in the United States have been unsatisfactory. Graphite crucibles are now lined with 0.25 inch of fire-clay, and their use prevents absorption of carbon. They are used for steel, German silver, nickel alloys and pure nickel.

J. W. RICHARDS.

**Apparatus to Determine the Melting Points of Slags.** BY W. MCA. JOHNSON. *Electrochem. Met Ind.* July, 1906, pp. 262–263.—A round 4-inch bar of Acheson graphite is sawed off 3.5 inches long, and a hole 1 inch in diameter bored in its top 1 inch deep, and then continued through the block as a 0.2-inch hole. Another hole for a thermo-couple is bored at right angles to this, reaching almost to the bottom of the 1-inch hole. The latter being filled with fragments of slag, the block was placed on supports in a furnace, and the “running” temperatures observed at which the slag ran through the 0.2-inch hole.

J. W. RICHARDS.

**Nodulizing and De-sulphurization of Fine Iron Ores and Pyritic Cinders.** BY A. L. COLBY. *Electrochem. Met. Ind.* September, 1906, pp. 351–352. (Read before the American Society Mining Engineers.)—An adhesive hydrocarbon or carbohydrate such as tar, pitch, asphalt, petroleum residue, dextrin, molasses, glucose, etc., is sprayed into the stream of fine ore as it enters a rotary kiln; 1 per cent. is sufficient. At the hot end of the kiln incipient fusion takes place. A large plant is being erected near Pittsburg.

J. W. RICHARDS.

**Balance Sheet of the Blast-Furnace.** BY J. W. RICHARDS. *Electrochem. Met. Ind.* April, 1906, pp. 129–132.—A discussion of the materials entering the furnace (fuel, ore, flux and blast), and their distribution into pig-iron, slag, dust and gases; illustrated by three detailed calculations and a problem concerning a complete balance sheet, from actual practice. J. W. RICHARDS.

**Calculation of Blast-Furnace Charge.** BY J. W. RICHARDS. *Electrochem. Met. Ind.* May, 1906, pp. 180–185.—Generalizations on compositions of slags, and calculations based thereon of flux needed, and fuel necessary. Also comparisons of the relative

values to the blast-furnace of different fuels, fluxes and ores, to determine the most economical to use and the items of total cost of the iron.

J. W. RICHARDS.

**Utilization of Fuel in the Blast-Furnace.** BY J. W. RICHARDS. *Electrochem. Met. Ind.* June, 1906, pp. 231-235.—Three problems discussing in specific cases the proportion of the calorific power of the fuel developed in a furnace, and the proportion developable from the combustion of the gases. Also discussion of "Grüner's ideal working" and a new view of the minimum carbon necessary for running the furnace.

J. W. RICHARDS.

**Heat Balance of the Blast-Furnace.** BY J. W. RICHARDS. *Electrochem. Met. Ind.* July, 1906, pp. 259-262; August, 1906, 303-306.—A discussion of the items of heat development (under five headings) and of heat distribution (under twelve headings), with particular attention to the thermochemistry of the reduction of the ore and formation of the slag. The second part contains a long problem applying these principles to a Pittsburg furnace.

J. W. RICHARDS.

**Hot Blast and Dry Blast.** BY J. W. RICHARDS. *Electrochem. Met. Ind.* September, 1906, pp. 358-360.—Discussion of the effect of heating the blast on the temperatures before the tuyeres, showing some 68° rise in the furnace temperature for each 100° rise in temperature of the blast; also the effect on the furnace temperature of varying amounts of moisture. A table is calculated, showing the theoretical maximum temperature for blast of 11 different temperatures (40° to 1000°) with, in each case, 8 different amounts of moisture (5 to 40 grams per cubic meter). The temperature before the tuyeres may vary as much as 235° (423° F.) from changes in the amount of moisture in the air.

J. W. RICHARDS.

**Blast Refrigeration and Power Requirements.** BY J. E. JOHNSON, JR. *Electrochem. Met. Ind.* September, 1906, p. 349. (Read before the American Institute Mining Engineers.)—Points out that of all the moisture in air saturated at 70° F., half is deposited, if it is cooled to 50° F., and about two-thirds at 25° F. Economy in refrigeration dictates that the air should be cooled in at least two stages, so as to avoid cooling all the condensed water to ice below 32° F. Cooling of compressed blast is not considered in the paper.

J. W. RICHARDS.

**New Developments in Dried Blast.** BY A. STEINHART. *Iron and Steel Mag.* June, 1906. (Read before the Technische Verein of Pittsburg.)—Describes a new method of reducing the amount of moisture in the blast to a small and but slowly varying amount, at a cost of only two cents per ton of iron made. The



air under pressure, say at 15 pounds effective pressure, is cooled by river water. The latter has a temperature of say 70° F. in summer and 35° F. in winter. Using this, in a water jacket, the amount of moisture can be kept down to about 4 grains per cubic foot in summer, and 1.5 grains in winter, and with slow variations between these extremes. The apparatus used is like a water tube boiler 60 feet high by 12 feet in diameter. First cost for a 400-ton furnace, \$20,000; cost of operation almost *nil*.

J. W. RICHARDS.

**Roe Puddling Process.** By J. P. ROE. *Electrochem. Met. Ind.* September, 1906, pp. 353-354. (Read before the American Society Mining Engineers.)—Description of the Roe mechanical puddling furnace, in which the iron and slag flow backwards and forwards in a heated trough. The final ball formed weighs 4,000 pounds. With 25 per cent. of silica in the final cinder, dephosphorization was practically *nil*; with 12 per cent. of silica only 0.06 per cent. of phosphorus remained in the finished iron, provided that the slag contained under 5 per cent. of phosphorus. Sulphur is completely eliminated.

J. W. RICHARDS.

**Air Furnace Practice.** By R. H. WEST. *Iron Age*, July 5, 1905, pp. 16-19. (Read before the American Foundrymen's Association.)—A comparison of air furnaces for melting pig-iron for foundry use, as used in six prominent works. Westmoreland gas coal is used, containing less than 1.30 per cent. of sulphur; 3.5 pounds of iron are melted per pound of coal; 24,000 pounds are melted in six to seven hours; charge, old rolls and charcoal pig-iron; natural draft used, blast under grate would be better. Bed, silica sand, patched with fire-clay. It requires greater skill to run than a cupola, and costs more; advantages are, lower sulphur in the iron, ability to control the composition while melted, larger amounts of metal available at one tap; stronger iron which is more resistant to corrosion; ability to melt down larger pieces of scrap than can go into a cupola. Area of hearth 77 to 114 square feet, of grate 25 to 36 square feet; capacity up to 45 tons, melted by 9 tons of fuel; chimney flue averages half the grate area.

J. W. RICHARDS.

**The Schwartz Steel Process.** *Iron Age*, April 26, 1906, pp. 1389-1390.—A process of making melted steel, in which pig-iron and scrap steel are melted in a cupola to a low carbon melt, containing some 2 per cent. of carbon. This is run into a Schwartz oil-fired furnace, where the carbon is reduced to 0.25 in two and one-half hours. Two converging tuyeres blow air upon the bath, to facilitate oxidation. Four tons of steel have been made in four hours, using 330 pounds of coke in the cupola and eighty gallons of oil in the furnace, per ton of steel.

J. W. RICHARDS.

**Steel Melting in an Electric Induction Furnace.** *Chem. Eng.* August, 1906, 176 (from *Eng. Rec.*).—The Colby electric induction furnace is in practical use at the Disston Saw Works at Tacony, near Philadelphia. Alternating current at 220 volts is used, and the amount used has been at the rate of 640 kilowatt-hours per ton of steel melted. The experiments have been so successful that a furnace of larger capacity is being built. [Current used represents 550,400 calories per ton of steel; melted steel contains 275,000 calories of usefully applied heat. Efficiency of furnace 50 per cent.—Abstractor.] J. W. RICHARDS.

**Electric Steel Melting.** *Iron Age*, June 7, 1906, pp. 1811–1813.—The Colby induction electric furnace now in operation at the Disston Saw Works, Philadelphia, is described with illustrations. The product stands all the requirements of high-grade crucible steel. The crucible used is graphite and clay, and holds 200 pounds of steel. A steel ring or some melted steel is put into the crucible and the current started, scrap iron, Swedish pig-iron and wash-metal are charged, the furnace content being usually 150 pounds, of which 90 to 100 are poured into an ingot, leaving 50 to 60 pounds to start the next run. The melting down takes twenty minutes, and “killing” and casting forty minutes, making about one charge every hour. The primary alternating current is at 220 volts, potential of induced secondary current probably 8 volts, average power consumption so far 640 kilowatt-hours per ton of steel made. If water-power, the cost should not be over \$3 to \$4 per ton. It is proposed to enlarge the furnace, until 3 or 6 tons capacity has been reached. J. W. RICHARDS.

**Piping in Steel Ingots.** BY N. LILIENBERG. *Iron and Steel Mag.* April, 1906, pp. 308–316. (Read before the American Institute Mining Engineers.)—Description of the Illingworth process of compressing ingots of steel while setting, the compression being applied on the sides of the moulds. Groups of moulds can be placed in one frame, side by side, and compressed in series. The moulds have compression pieces in the sides. Illustrations of the machinery used are given.

J. W. RICHARDS.

**Segregation in Steel Ingots.** BY C. L. HUSTON. *Iron Age*, July 5, 1906, pp. 1–6. (Read before the American Society Testing Materials.)—Several ingots of mild steel were planed through, in order to show their internal section, and test pieces from 30 different parts tested for carbon and tensile strength. The results on ingots of differing shapes are very interesting, showing the increase of carbon and tensile strength from the outside towards the center. The minimum and maximum of the carbons were, in percentages, in the same ingot, 0.13–0.27; 0.22–0.38; and

of tensile strengths, 55,400-67,420, 64,190-72,160 pounds per square inch.

J. W. RICHARDS.

**Internal Stresses and Strains in Iron and Steel.** BY HENRY D. HIBBARD. *Bull. Am. Inst. Min. Eng.* September, 1906, pp. 707-724.—The discussion of strains and stresses in iron and steel is divided into two divisions, those caused by an irregular rate of change of temperature and those caused by cold working at temperatures below that at which the metal is softened. The intensity of the strain brought about by the first cause depends upon these factors, the rate of change of temperature, the shape of the piece, the volume of the piece, the elastic limit of the metal, the ductility of the metal, and the coefficient of expansion of the metal. Suggestions are made throughout the paper as to the possibility of relieving strains induced by these various causes.

HENRY FAY.

**The Relative Corrosion of Wrought Iron and Steel.** BY H. M. HOWE. *Iron Age*, June 28, 1906, pp. 2047. (Read before the American Society for Testing Materials.)—Contains no results of tests, but a compilation of observations, from which the conclusion is drawn that there is practically no difference except that wrought iron does a little better than steel in sea-water.

J. W. RICHARDS.

**Coal Dust Firing in Reverberatory Matte Furnaces.** BY S. S. SÖRENSEN. *Eng. Min. J.* February 10, 1906.—Grate firing has been replaced by coal-dust firing, using a single flattened nozzle 1.5 inches by 24 inches, placed 30 inches back of the bridge wall. No trouble was found in keeping the furnace hot, and in a two months' run the furnace melted 30 per cent. more calcines with 24 per cent. less coal per ton; counting in the 30 to 60 indicated horse-power consumed in powdering and projecting the coal into the furnace, there remained a net saving of 15 to 20 per cent. of fuel over the grate-fired furnaces, besides the saving in labor of "graters" to clean up and attend the fireplaces.

J. W. RICHARDS.

**The Nichols Copper Works.** BY O. PUFAHL. *Eng. Min. J.* February 17, 1906.—The ores are smelted in two water-jacket Herreshoff furnaces to 40 to 60 per cent. matte, using 23 to 26 tons of ore and flux to one of coke. The matte, together with all mattes purchased, is melted down in a cupola, using 9 per cent. of coke, and taken to converters, of which there are 12, eight being usually in operation. The charges are two to six tons, blast-pressure 8 to 10 pounds per square inch, and the product of the plant 150 tons of 99 to 99.25 per cent. copper. Every 10 to 16 charges the converter is re-lined. Blowing engines 220 horse-power, gas flues 1,000 feet long, connecting with a



300 feet chimney, and yielding 100 tons of flue dust monthly. The blister copper is cast into anodes, which are pressed smooth between rollers after casting. The anodes are 59 inches long, 16 inches wide, 0.5 inch thick, weighing about 67 pounds, and are refined by the series system. Eight reverberatory furnaces of 30 to 45 tons capacity are used to melt down the cathode copper. The current for electrolysis is generated by 17 dynamos, each of 800 amperes at 155 volts.

J. W. RICHARDS.

**The Baggaley Pyritic Conversion Process.** BY R. M. BAGGLEY. *Eng. Min. J.* March 24, 1906.—The low-grade pyritic ore is first subjected to pyritic smelting with 7 to 10 per cent. of coke, producing low-grade matte. This may be replaced by a sort of continuous converter, consisting of a basic-lined hearth 20 feet by 8 feet, containing a bath of melted matte, and provided with 36  $1\frac{1}{4}$ -inch tuyeres. The ore is fed into the bath at one end, and as it passes to the other end its sulphides are melted and its gangue slagged, while the oxidation of iron sulphide provides the necessary heat. The slag and matte run into a settler, where they separate into the slag with 0.1 per cent. copper and 15 per cent. matte. The melted matte is fed into converters, with preheated siliceous ores carrying gold and silver. Butte ores thus dissolve in large amount. The slag is returned, melted, to the feed end of the primary ore converter. These secondary converters enrich the matte to about 76.5 per cent. The second matte is put into 4-ton converters lined with 12 inches of good silica brick, and run down to blister copper. J. W. RICHARDS.

**The Determination of Matte.** BY J. P. WALKER. *Eng. Min. J.* May 5, 1906, p. 852.—Numerous analyses of "Boston and Montana" reverberatory mattes show them to be only 95 to 96 per cent.  $\text{Cu}_2\text{S} + \text{FeS}$ . Some iron is present in addition, partly as intermingled slag and partly as  $\text{Fe}_3\text{O}_4$ . On an average, 30 per cent. of the sulphur in the calcined ore is lost during the reverberatory fusion, and neglecting the copper lost as dust, the weight and copper content of the matte to be expected from any given roasted ore can be calculated.

J. W. RICHARDS.

**Brass Melting in an Electric Induction Furnace.** *Brass World*, September, 1906, pp. 291-295.—Description with photographs of the Colby furnace, as used experimentally in the shops of the General Electric Company, Schenectady, N. Y. The crucible is a circular slot 2 inches wide, 6 inches deep and 8 to 10 inches in diameter, capable of melting 200 pounds of metal at once; the material for brass melting is graphite and clay mix. Brass turnings were filled into the slot, and 50 pounds, starting cold, were melted in twenty-four minutes, using 16 kilowatts of current, which is about one-third as much as is needed to melt that weight

of iron. [Current used represents 4,500 calories expended; brass melted represents 2,950 calories of usefully applied heat. Efficiency of furnace, 65 per cent.—Abstractor.]

J. W. RICHARDS.

**Effect of Arsenic in Brass.** BY E. SPERRY. *Brass World*, May, 1906, pp. 163-164.—Yellow brass (Muntz metal) containing 60 per cent. copper to 40 zinc was made from the best electrolytic copper and "Bertha" spelter, and 20 per cent. arsenic-copper alloy was introduced to give the required arsenic. 0.5 per cent. arsenic made the brass more fluid, and limpid like phosphor bronze, but the ingot was strongly crystalline, would not roll and cracked to pieces in "breaking down." With 0.25 per cent. the fracture showed slight crystallization, but could be rolled, cracking badly on the edges. With 0.10 per cent. only traces of crystallization were seen, and the ingot rolled down easily, but with cracks on the edges. With 0.05 per cent. the fracture was free from crystallization, but cracks still showed slightly on the edges in "breaking down." With 0.02 per cent. a great change was produced; the metal was extra clean and fluid, rolled perfectly and possessed a ductility which was surprising, standing very heavy reductions without cracking, in a way unknown to ordinary brass. With arsenic 0.01 per cent. the results were not so good. The function of the 0.02 per cent. is probably to reduce oxide of copper. Lake Superior copper frequently contains just about this amount, and therefore produces superior results. Most uniform results can be secured by using pure electrolytic copper and adding the 0.02 per cent. of arsenic as arsenic-copper alloy.

J. W. RICHARDS.

**High Lead Bronzes.** BY J. JONES. *Metal Industry*, April, 1906, pp. 81-82.—In order that a bronze may retain a high percentage of lead, the mass must set quickly at a temperature above the melting-point of lead, thus enmeshing the latter. Antimony, iron, manganese, sulphur, nickel and phosphorus all exert this effect. Formulas of several are given. The lead is more likely to separate when the alloy is poured at a low heat than when poured hot; there is also more separation in ingots cast in iron molds than in those cast in sand. If either the copper or lead oxidize in the crucible, a poor mixture results; the copper should be well protected by lime and charcoal, while a little magnesium added before pouring may be of service.

J. W. RICHARDS.

**Electrodeposition of Bronze.** BY B. E. CURRY. *Electrochem. Met. Ind.* June, 1906, p. 225. (Read before the American Electrochemical Society.)—Ammonium oxalate solutions containing copper and tin were electrolyzed, using as anodes copper-tin alloys of varying composition. A good bronze deposit cannot be made containing over 20 per cent. of tin.

J. W. RICHARDS.

**Nickel-Copper Valve Seats.** *Brass World*, April, 1906, p. 128.

—The seats of valves, to withstand corrosion, are now being made of an alloy of 48 parts nickel and 50 copper, to which is added, just before pouring, 2 parts of 10 per cent. silicon-copper. The metal is poured, and remelted once or twice before being cast into shape.

J. W. RICHARDS.

**Electrochemical Processes for Extracting Silver and Gold.**

BY M. VAYGOUNY. *Electrochem. Met. Ind.* August, 1906, pp. 314-316. (From Thesis for Ph.D. at University of California.)—Two new processes were outlined by the experiments. The first uses acid solutions of ferric chloride or sulphate, in presence of much hydrochloric acid or sodium chloride or other soluble chloride, the latter acting as solvents for silver chloride. The average extraction was over 95 per cent. of the silver and 60 to 88 per cent. of the gold, varying with the nature of the ore. The reoxidation of the ferrous salts is performed electrolytically. The second method is based on the use of concentrated chloride solutions, the oxidation of the silver and gold being produced by persulphates. The metals themselves are slowly oxidized and dissolved, but sulphides rapidly. After deposition, the solutions can be oxidized again to persulphates electrolytically. The best solution found was 2 per cent.  $K_2S_2O_8$ , 5 per cent.  $H_2SO_4$  and 20 per cent.  $NaCl$ . No figures of efficiency of this method are given.

J. W. RICHARDS.

**Electrolytic Precipitation of Gold from Cyanide Solutions.**

BY B. NEUMANN. *Electrochem. Met. Ind.* August, 1906, pp. 297-302.—A record of experiments to determine the ampere efficiency in electrolyzing dilute solutions, using various current densities, concentrations and lengths of run. Low efficiency is obtained at the beginning of electrolyses, if fresh lead plates are used, the loss being apparently due to the condition of the surface of the electrodes. With 0.5 per cent.  $KCN$  and 10 grams of gold per cubic meter of solution, a current density of 0.5 ampere per square meter gave 0.92 per cent. efficiency the first hour, and 3.81 per cent. in the first five hours (maximum); using 3 grams of gold per cubic meter, the efficiency was 0.007 per cent. the first hour, increasing to a maximum of 1.33 per cent. in eight hours. Using 0.05 per cent.  $KCN$  solution, current density of 0.25 ampere, and 10 grams of gold per cubic meter, the efficiency of deposition was 0.67 per cent. in two hours, increasing to 7.56 per cent. in ten hours; with 3 grams of gold it was 0.38 per cent. during four hours, increasing to 3.15 per cent. in fourteen hours. With higher current densities the ampere-hour efficiency becomes very poor, not even reaching 0.5 per cent. with over 2.4 amperes per square meter or over. Running forty-five days with 2.5 amperes density, the efficiency was only 0.12 per cent. Conclusion is that in all



commercial work the efficiency of deposition is usually below 1 per cent. Christy's method of redepositing the gold plating was tried with current densities of 24 to 69 amperes per square meter, giving efficiencies of plating over of 0.45 to 0.03 per cent. Using gold chloride solution, efficiencies of 48 to 66 per cent. were obtained, the gold depositing as univalent gold, not trivalent. More gold is deposited than is dissolved, the electrolyte growing poorer, which is a practical difficulty for Christy's idea.

J. W. RICHARDS.

**Gold and Silver Refining.** BY D. K. TUTTLE. *Electrochem. Met. Ind.* August, 1906, pp. 306-7. (From Report Director U. S. Mint, 1905.)—The Philadelphia and Denver mints now refine both gold and silver electrolytically. The non-coherence of the deposited silver in the Moebius refining process has been obviated by adding a small amount of gelatin to the solution, giving dense, adherent and solid cathode deposits. If the current is continued after nearly all the silver has been dissolved from the anodes, oxygen is evolved freely and produces from the spongy gold a small but notable quantity of gold trioxide, which goes into the solution. It is deposited from the solution as a fine precipitate by dilution. Platinum remains with the gold, and the latter is afterwards electrolytically refined. Necessary losses are less than 0.01 per cent.

J. W. RICHARDS.

**The New Denver Mint.** BY R. L. WHITEHEAD AND F. E. HEALY. *Mines and Min.* September, 1906, pp. 54-57.—Illustrated description, including the electrolytic plants for refining gold (Wohlwill process) and silver (Moebius process). In the gold refining, anodes are made 940 to 950 fine, with not over 50 of silver. Current density 60 amperes per square foot; capacity 100,000 ounces of refined gold per week. The silver refining tanks are eight in number, of Bertuch earthenware, 26 by 47 inches by 22 inches deep; electrolyte contains 2 per cent. free nitric acid and 3 per cent. silver nitrate. Anodes 5 to 20 per cent. of base metal and 25 to 30 per cent. gold; suspended by gold hooks. Cathodes silver, brushed with paraffin, the deposit being stripped off. Current density 20 amperes per square foot. Rockwell fuel-oil furnaces are used to melt the gold and silver.

J. W. RICHARDS.

**The Zinc Industry in 1905.** BY F. MEYER. *Electrochem. Met. Ind.* March, 1906.—Southwest Wisconsin has produced high-grade concentrates, to an extent which makes it an important competitor of Missouri. The Wisconsin blende is not magnetic, and the concentrates are first roasted, to render the iron sulphides magnetic, and then separated on ordinary magnetic concentrators. In Colorado, where the blende is magnetic, Wetherill machines are used to pick it out, without roasting. Of

mechanically-stirred muffle furnaces for roasting blende, the Hegeler kiln is still the only one used in the United States. Two new zinc works are being built at De Pue, Illinois and at Danville, Illinois. No improvements of a revolutionary character have been made in the reduction of the ores. J. W. RICHARDS.

**Roasting of Zinc Sulphide.** BY W. E. GREENAWALT. *Eng. Min. J.* February 3, 1906.—Zinc blende was roasted with ordinary conditions of air and temperature, and 1.17 per cent. of sulphur as soluble sulphate was obtained; roasted at same temperature with a large amount of air, and only 0.66 per cent. of soluble sulphur was obtained, showing that the presence of much air is not conducive to the formation of sulphate. A sample of ore was taken from an ore bed below the stirring rabbles, where it had been subjected to prolonged heat with insufficient air, and it was found that practically all of the sulphur in this was converted into sulphate. J. W. RICHARDS.

**The Palmerton Works of the New Jersey Zinc Company.** BY O. PUFÄHL. *Eng. Min. J.* February 10, 1906.—The works employs 1,000 men; the ore from Franklin, N. J., is willemite concentrate, 47 to 48 per cent. zinc, worked to metallic zinc, and franklinite concentrate with 23 per cent. ZnO, used for zinc white. The spelter plant consists of two Siemens furnaces containing 256 retorts, and two Convers and de Saulles furnaces with 320 retorts, fired by 12 Dawson gas producers, gasifying 96 tons of coal per twenty-four hours. Eight new furnaces, containing 1600 muffles are being built. The charges per retort are 37 pounds of concentrate with 21 pounds of coal for reduction; the residues contain 5 per cent. Zn, and the spelter produced over 99.9 per cent. Zn. The muffles last one month. The oxide plant contains 480 Wetherill blowing hearths, and the product is 105 tons of oxide daily, which is being increased to 120 tons. The residues are run down to spiegeleisen, carrying 10 to 20 per cent. manganese and 0.03 per cent. phosphorus, in a 60-foot high blast-furnace, producing 51 tons daily. The slag runs 6 per cent. Mn. Lithopone is also made by dissolving waste zinc residues in sulphuric acid, precipitating iron and manganese by chloride of lime, and Cu, Co, Ni and Cd by boiling with zinc dust. The barium sulphide solution is made by calcining German barite with coal and leaching the product. The two liquors being mixed, the precipitate is collected and washed in a filter-press, dried, calcined in muffles and quenched at a red heat in water. It is then ground moist, washed, collected in a filter-press, dried, broken up and ground to a flour. A small contact sulphuric acid plant has a five-hearth O'Brien roaster, which roasts Newfoundland pyrites down to 5 per cent. sulphur. The gases are purified from dust by passing through asbestos filters laid on perforated lead sheets,

then raised to 500° in vertical cast-iron pipes heated with coal, then passed into the Grillo-Shroeder contact apparatus. The  $\text{SO}_3$  is absorbed by sulphuric acid of 60° B. This company owns the American patents for this process. J. W. RICHARDS.

**The Lungwitz Process of Zinc Smelting.** BY F. W. GORDON. *Eng. Min. J.* April 28, 1906, pp. 795-797.—A discussion of the reduction of zinc ore in shaft furnaces under pressure, at Warren, N. H. Blast of 100 pounds pressure was used, but after some (unsuccessful) attempts, work was deferred until the next year. There is a long argument to show that the furnace must ultimately succeed. It can be proven, in one-tenth the number of words, that success with it is impossible. J. W. RICHARDS.

**Gold Galvanizing.** *Iron Age*, June 21, 1906, pp. 1980-1982.—An illustrated description of the Potthof process used by the U. S. Electro galvanizing Co., Brooklyn. The plant has 9 tanks 16 to 24 feet long for jobbing work, and another plant for galvanizing pipe and bar-iron. Time for plating an object thirty to forty-five minutes. Small articles are galvanized in rotating barrels. One man handles 6 to 8 barrels, galvanizing 5 to 6 tons of articles per day. Wire is galvanized continuously, 6,000 to 10,000 feet being run through in ten minutes. J. W. RICHARDS.

**Electric Lead Smelting.** BY A. G. BETTS. *Electrochem. Met. Ind.* May, 1906, pp. 169-173.—The electric furnace is bound to give a larger saving of lead, because of the absence of air, which causes volatilization. Electrolytic lead smelting has been experimented with by the writer and Dr. Wm. Valentine, dissolving lead sulphide in fused lead chloride and electrolyzing out the lead and sulphur, thus saving 250 pounds of sulphur per ton of galena, and recovering all the lead. Iron interferes greatly, making a thick scum. It is then proposed to first melt the ore to matte in an electric furnace, and then electrically reduce the matte under such conditions that iron is not reduced. Comparisons are made of probable cost, with the ordinary smelting process, showing that where the latter costs \$4 per ton, the electric method might cost \$3 to \$5, according to local conditions. J. W. RICHARDS.

**Lead Wool.** *Brass World*, July, 1906, pp. 242-243.—This is a new material of commerce, the threads being from the thickness of hair to larger diameters. Its use is to calk joints of pipes, being calked into the joints like oakum, when it makes a solid lead joint, obviating the use of melted lead. J. W. RICHARDS.

**Deposition of Iron with Nickel.** *Brass World*, September, 1906, p. 317.—Nickel platers use anodes containing 5 to 10 per cent. of iron, to facilitate the solution of the anode. Most of the iron



thus dissolved deposits as hydrated oxide in the bottom of the bath. Analyses of the nickel-plating, obtained on brass, showed 1.11, 2.20, 1.89 and 1.67 per cent. of iron in the deposited nickel. This accounts for the notoriously poor quality of modern nickel-plating.

J. W. RICHARDS.

**Black-Nickel Plating.** BY F. NOIR. *Brass World*, August, 1906, pp. 263-266.—This black electrolytic plating is obtainable on any surface which can be white-nickeled. The bath contains water 1 gallon, nickel-ammonium sulphate 8 ounces, KCNS 2 ounces,  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  crystals 1 ounce. The deposit is blackened by the presence of the zinc in the solution, as without it the deposit is steel-gray. The solution is operated cold, at 1 to 2 volts potential, using about half the current used for white-nickel plating. The anode surface must be large, and ammonia added quite sparingly, to just neutralize the solution without forming a precipitate. The deposit is adherent and tough, and is preferably lacquered.

J. W. RICHARDS.

**Reduction of Molybdenum Sulphide.** BY O. W. BROWN. *Electrochem. Met. Ind.* June, 1906, p. 218. (Read before the American Electrochemical Society.)—Molybdenite,  $\text{MoS}_2$ , is easily and completely reduced to solid metal by electric smelting with lime and carbon, according to the reaction:



A maximum of 0.25 per cent. sulphur was found in the resulting metal. An excess of lime in the charge seems to assure complete reduction, but an excess of carbon leads to the formation of molybdenum carbide. Reduction of  $\text{Sb}_2\text{S}_3$  by an analogous reaction is incomplete, even at a very high temperature.

J. W. RICHARDS.

**Molybdenum Bronzing.** *Brass World*, June, 1906, pp. 193-194.—An electrolyte is made of water 1 gallon, strong ammonia 4 ounces, molybdc acid 2 ounces. The acid is first made up to a paste with a little water, and then the ammonia added. The article to be bronzed is used as cathode, being first cleaned in the ordinary way for plating. Sheet iron is used as anode; carbon or lead are not so good. The solution is used at room temperature, and 6 volts potential is put on. The surface first evolves a little gas, then becomes golden yellow, next green, purple and finally red. The surface is usually variegated. If the current acts too long, the color is reddish-brown to dark brown, and becomes brittle and may flake off. The article is rinsed and lacquered. The deposits are various molybdenum oxides.

J. W. RICHARDS.

**Sodium Production.** BY E. A. ASHCROFT. *Electrochem. Met. Ind.* June, 1906, pp. 218-221. (Read before the American Electrochemical Society.) The author estimates the production

as 3,500 tons yearly, about one-third in each of the three countries Germany, England, United States. The uses are approximately 1,500 tons for making cyanide, a like amount for peroxide, and 500 tons sold as metal. The selling price on large contracts is about 25 cents per pound; the cost is itemized, 0.05 cent per pound for caustic soda, 1 to 5 cents for power, 2.5 cents for labor and 2 cents for general expenses, total 10.5 to 14.5 cents. The author then describes his new process, consisting of electrolyzing fused common salt, using a melted lead cathode, and then electrolyzing with the lead alloy as anode in fused caustic soda. By this process, the costs are figured out as 5 to 9 cents per pound, according to the cost of power; that is, 5.5 cents per pound cheaper than the Castner process.

J. W. RICHARDS.

**Factory Scale Experiments with Fused Electrolytes.** By E. A. ASHCROFT. *Electrochem. Met. Ind.* April, 1906, pp. 143-146; May, 1906, pp. 178-180; September, 1906, pp. 357-358.—These papers deal with experiments on the electrolysis of fused zinc and lead chlorides, the direct electrolysis of metallic sulphides, the magnetic stirring of fused bath, the electrolysis of fused sodium chloride and the production of the alkali metals. When metallic sulphides are suspended in fused halogen salts and the current passed, they are decomposed, the metals being liberated at the cathode and sulphur at the anode. Lead and zinc are thus easily reduced. Several diagrams are shown of apparatus suitable for carrying out the processes described.

J. W. RICHARDS.

**Electric Cleaners for Plating Work.** *Brass World*, September, 1906, pp. 297-300.—The article to be cleaned from grease, scale, dust and dirt is hung in a solution as cathode, a strong current is used, and the electrolytically generated gas mechanically removes or pushes off the contaminations on the surface. The bath used is preferably, water 1 gallon, caustic soda or potash 0.5 pound, KCN 1 pound, used hot or cold. Six volts will provide sufficient current. An exhaust fan must be used to remove the mist or spray rising from the bath. The cleaned articles are rinsed, and placed directly in the plating bath. Mineral oils are not saponified, but are removed and float up to the surface of the bath; they will get on to the article again as it is removed from the bath, unless it is dragged under a partition and removed where the surface is free from oil.

J. W. RICHARDS.

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## ORGANIC CHEMISTRY.

**The Use of the Partition Principle. VI. The Action of Hydrochloric Acid on Propylene Oxide and Propylene Alcohol.** BY ARTHUR MICHAEL. *Ber.* 39, 2785-2789.—The action of hydrochloric acid on propylene oxide should give, according to

theory, a mixture of  $\text{CH}_3\text{CHClCH}_2\text{OH}$  and  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{Cl}$ , with the latter in considerable excess. The presence of the first could not be definitely proven in the reaction product. The product of the reaction boiled at  $127\text{--}127.5^\circ$  and had a specific gravity of 1.113 while 1-chloropropanol-2, from allyl chloride, boils at  $126\text{--}126.5^\circ$  and has a specific gravity of 1.115. Oxidation of the product from propylene oxide with chromic acid gave chloracetone; with nitric acid, chloracetic acid. Phosphoric anhydride gave a mixture of allyl chloride and 1-chloropropylene in about the same proportions. The action of hydrochloric acid on propylene alcohol gave similar results. V. J. CHAMBERS.

**The Use of the Partition Principle. VII. The Action of Hydrochloric Acid on Isobutylene Oxide.** BY ARTHUR MICHAEL AND VIRGIL L. LEIGHTON. *Ber.* 39, 2789-2795.—The action of hydrochloric acid on isobutylene oxide gave a mixture shown to be one part  $(\text{CH}_3)_2\text{CClCH}_2\text{OH}$  and two parts  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{Cl}$ . It readily gave considerable amounts of isobutyric aldehyde. Eleven of its 32 per cent. of chlorine was easily split off with water. Phosphoric anhydride gave a mixture of isomeric chlorisobutylenes, only two-thirds the quantity gotten from pure  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{Cl}$ . This article also contains a theoretical discussion that does not admit of satisfactory abstracting.

V. J. CHAMBERS.

**Triphenylmethyl. XIV.** BY M. GOMBERG AND L. H. CONE. *Ber.* 39, 2957-2970.—The method previously described for obtaining highly phenylated derivatives of methane and ethane by action of alkyl magnesium chlorides on triphenylmethyl chloride was continued with other alkyl magnesium halides. The products obtained in previous work were also more thoroughly investigated. (1) *Hydrocarbons*.—Unsymmetrical tetraphenylethane. The isomer melting at  $140^\circ$  obtained by Hanriot and Saint-Pierre by action of benzyl chloride on the potassium compound of triphenylmethane was shown to be unsymmetrical tetraphenylethane. This body boils at  $277\text{--}280^\circ$  at 21 mm. *1,1,1-Triphenylpropane* had been thought to be present in the oily product obtained by the interaction of triphenylmethyl chloride and ethyl magnesium bromide. Crystals of this body, m. p.  $51^\circ$ , were obtained by seeding the product with a crystal of triphenylbutane. Triphenylmethyl chloride and zinc ethyl were shown to give not only the triphenylmethane and ethylene obtained by earlier workers but also small amounts of *1,1,1-triphenylpropane*. The oily product obtained by Hanriot and Saint-Pierre by action of ethyl iodide and potassium triphenylmethane was shown to be mainly the above propane. *1,1,1-Triphenylbutane*.—Fine needles or large hexagonal plates melting at  $79^\circ$ . *1,1,1-Triphenylethane* was the sole product of the reaction of methyl magnesium iodide on triphenylmethyl chloride, no



olefine being observed. *1,1,1-Triphenylisobutane* was obtained only as an oil boiling at  $233-234^{\circ}$  at 21 mm. *1,1,1-Triphenylisohexane* was also gotten as an oil. (2) *Nitro-compounds*.—The above hydrocarbons were nitrated at  $-10^{\circ}$  with fuming nitric acid and renitrated, if analysis showed less than one nitro group for each phenyl group. They all gave the fuchsin reaction and are therefore para derivatives. *Tetranitro-asymm.-tetraphenylethane*.—Two isomers were obtained melting at  $258^{\circ}$  and  $269^{\circ}$  and both showing the fuchsin reaction. *Trinitro-1,1,1-triphenylpropane*, yellow tables, m. p.  $194-195^{\circ}$ . *Trinitro-1,1,1-triphenylbutane*, m. p.  $191-192^{\circ}$ . *Trinitro-1,1,1-triphenylisobutane*, m. p.  $262-263^{\circ}$ . *Trinitro-1,1,1-triphenylhexane*, m. p.  $207-208^{\circ}$ . (3) *Action of Molecular Silver on Phenylchlorfluorene*.—It does not give a hydrocarbon of the hexaphenylethane type as originally thought but the peroxide of phenylfluorene, the reaction being analogous to that of triphenylmethyl chloride under similar conditions. *Phenylbenzylfluorene* was obtained in a manner similar to *asymm.-tetraphenylethane*. Long crystals, melting at  $136^{\circ}$ . Molecular silver and a solution of phenylchlorfluorene gave a fluorescent solution that absorbed oxygen less readily than a similar solution of triphenylmethyl. The final product was *phenylfluorene peroxide* that crystallizes from benzene in tables containing two molecules of the solvent, which it loses easily, m. p.  $193^{\circ}$ . The preparation of this body by the action of sodium peroxide on phenylchlorfluorene takes place very slowly and the yield is poor.

V. J. CHAMBERS.

**On the Preparation of the Cyanamides.** BY RALPH H. MCKEE. *Am. Chem. J.* **36**, 208-213.—The author has discovered a rapid and convenient method for the preparation of the cyanamides from the amines in large yield. One molecule of the amine is added to an aqueous solution of four and a half molecules of potassium cyanide; the temperature of the solution is maintained below  $15^{\circ}$  and 1.1 molecules of bromine, dissolved in ligroin or in ethyl acetate, added gradually with constant shaking. The ligroin or ethyl acetate solution is separated, washed with dilute alkali, dried, and fractioned under diminished pressure. *Methylcyanamide*,  $\text{CH}_3\text{NHCN}$ ; yield poor (30 per cent.), and product not perfectly pure. *Dimethylcyanamide*,  $(\text{CH}_3)_2\text{NCN}$ ; b. p.  $98^{\circ}$  at 104 mm.,  $164^{\circ}$  at 740 mm.; yield, 50 per cent. *Ethylcyanamide*,  $\text{C}_2\text{H}_5\text{NHCN}$ ; yield, 71 per cent. *Diethylcyanamide*,  $(\text{C}_2\text{H}_5)_2\text{NCN}$ ; b. p.  $188-189^{\circ}$  at 748 mm. *Dipropylcyanamide*,  $(\text{C}_3\text{H}_7)_2\text{NCN}$ ; b. p.  $95^{\circ}$  at 11 mm.; yield, 93 per cent. *Diisobutylcyanamide*,  $(\text{C}_4\text{H}_9)_2\text{NCN}$ ; b. p.  $123^{\circ}$  at 25 mm.; yield, 83 per cent. *Isoamylcyanamide*,  $\text{C}_5\text{H}_{11}\text{NHCN}$ . *Diisoamylcyanamide*,  $(\text{C}_5\text{H}_{11})_2\text{NCN}$ ; b. p.  $134^{\circ}$  at 14 mm.; yield, 92 per cent. *Benzylcyanamide*,  $\text{C}_6\text{H}_5\text{CH}_2\text{NHCN}$ ; m. p.  $43^{\circ}$ ; yield, 90 per cent. *Cyanpiperidine*,  $\text{C}_5\text{H}_{10}\text{NCN}$ ; b. p.  $102^{\circ}$  at 11 mm.; yield, 80 per cent. The reaction failed with ani-

lines and amides. *Unsymmetrical Methyldipropylisourea* (*Methyl Imidodipropylcarbamate*),  $(C_3H_7)_2NC(:NH)OCH_3$ , from dipropylcyanamide and sodium methylate in methyl alcohol solution (yield, 80 per cent.), boils at  $98^\circ$  at 19 mm., or  $203^\circ$  at 748 mm. Specific gravity at  $22^\circ/4^\circ$  (Westphal), 0.9103. It is the first known oxygen ether of the ureas with two alkyl groups attached to nitrogen, the first isourea to boil undecomposed at atmospheric pressure, and is more soluble in cold than in warm water. *Unsymmetrical Methyldiethylisourea* (*Methyl Imidodiethylcarbamate*),  $(C_2H_5)_2NC(:NH)OCH_3$ , boils at  $171-172^\circ$  at 745 mm. It is a strong monacid base which may be titrated directly with hydrochloric acid, using methyl orange as indicator.

M. T. BOGERT.

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## BIOLOGICAL CHEMISTRY.

**Studies in Absorption.** BY B. H. BUXTON AND J. C. TORREY. *J. Med. Research* **15** (New Series 10), 5-89; also *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.

*I. Absorption of Inert Particles from the Peritoneal Cavity.*—Such inert particles as lampblack were injected into the peritoneal cavity of guinea pigs and an examination was made of the peritoneal fluid and of various organs. It is shown that some of the particles which remain in the peritoneal cavity are there taken up first by the polynuclear leucocytes and later by the mononuclear macrophages. Some of the particles leave the peritoneal cavity and very rapidly reach the organs where they may be found in immense numbers. They occur in greatest number in the liver and spleen.

*II. Absorption of Typhoid Bacilli from Peritoneal Cavity.*—After intraperitoneal injection of typhoid bacilli into rabbits there may be an explosive destruction of the vast majority of the bacilli, few or none reaching the organs in such cases. The destruction may take place more slowly though still strikingly manifest one hour after inoculation. In the latter case large numbers of the bacilli find their way into the circulation almost immediately, being rapidly deposited from the blood in the various organs. The organs vary greatly in their power of holding up the bacilli, the liver being invaded to the greatest extent. The number of bacilli in the organs rapidly decreases again after the first few minutes up to about two hours after inoculation. From two to six hours there is a considerable increase, probably due to the body fluids having expended all their energy, thus permitting multiplication of the bacilli. From six hours to forty-eight hours there is again a decrease, rapid in the liver, but more gradual in the spleen. The second period of decrease is probably due to the action of the phagocytes although recovery of the bactericidal

action of the body fluids may also be a factor. Neither the urine nor the bile appear to be channels of excretion under the conditions of the experiments. The variations of temperature between the time of inoculation and that of bleeding afford no indication of what the results of the experiments are likely to be. Experiments with rabbits serum *in vitro* give no clue as to what will happen *in vivo*.

III. *The Function of the Diaphragm in Absorption from the Peritoneal Cavity.*—After intraperitoneal injections of suspensions there is an immediate rush of particles to the lymphatics of the diaphragm. From the diaphragm the particles are carried along the anterior mediastinal lymphatic trunks and through the lymph nodes, reaching the thoracic duct and blood current almost immediately after injection. Throughout their whole course from the peritoneal cavity to the organs the particles in the earliest stages are practically in a free condition, being taken up later by the phagocytes. In the anterior mediastinal lymph nodes phagocytosis by the macrophages is the most prominent feature, the microxocytes taking comparatively little part. This applies not only to inert particles and animal cells but also to bacteria. Whether the particles pass into the lymphatics of the diaphragm by stomata or gain entrance between the endothelial lining cells could not be determined.

IV. *The Function of the Omentum in Absorption from the Peritoneal Cavity. (Inert Particles.)*—Almost immediately after injection of inert particles into the peritoneal cavity of the guinea pig there is a deposit of fibrin formed on the surface of the omentum in which the particles and phagocytic cells of the cavity become entangled. The phagocytic cells (macrophages) rapidly englobe the particles, becoming filled with small particles like lampblack within ten minutes and with chicken red cells in about an hour. If not overloaded, the macrophages then enter the tissues and appear as long trailers or clasmatoocytes. If the particles are digestible, *e. g.*, chicken red cells, they are rapidly disposed of by the phagocytes. If the particles are not digestible, *e. g.*, lampblack, they remain inside the macrophages and trailers for months. The particles in the trailers become fragmented and after a time are discharged as minute fragments (clasmatosis of Ranvier). The macrophages are the most active agents of phagocytosis on the omentum, the polynuclear leucocytes playing a minor part.

V. *The Function of the Omentum in Absorption from the Peritoneal Cavity (Typhoid Bacilli).*—After intraperitoneal injection of typhoid bacilli into a rabbit the bacilli became fixed in immense numbers on the surface of the omentum. Some may lie free in the fibrinous deposit or over the surface of the milky spots. Some may be contained in macrophages. The bacilli



may be rapidly destroyed either extracellularly or intracellularly or may remain partly intact for some time. If they are rapidly destroyed, there is a good microxycyte reaction in four to six hours. If in four to six hours the microxycytes do not arrive in great numbers, secondary centers of multiplication become evident. The secondary centers of multiplication are no longer present in sixteen to twenty-four hours, if the rabbit appears to be recovering. If the rabbit is dying or dies between sixteen and twenty-four hours, secondary centers of multiplication are marked features. As with inert particles the macrophages take the chief part in phagocytosis. Nevertheless, the macrophages cannot effectively dispose of the bacilli unless there is a considerable microxycyte reaction.

F. P. UNDERHILL.

### **Microscopic Evidences of Absorption in the Large Intestine.**

BY JOHN LEWIS BREMER. *J. Med. Research*, **15** (New Series 10), 89-97.—Food is absorbed in the large intestine (and in the cecum of those animals with large ceca) in the same way as in the small intestine but to a smaller extent. The process goes on in the epithelium of the surface and in that of the glands, but seems to be retarded or stopped, if the mucous cells become very active. The same cycle of spherule formation is seen in the epithelium cells; absorption by leucocytes is also present. This seems to represent the absorption of proteids.

F. P. UNDERHILL.

**The Relation of Autolysis to the Histological Changes Occurring in Necrotic Areas.** BY H. GIDEON WELLS. *J. Med. Research* **15** (New Series 10), 149-167.—In typical areas of anemic necrosis, such as infarcts, etc., the changes that occur are as follows: There is first a decomposition of the nucleoproteids of the nuclei, which is probably brought about by the intracellular enzymes of the starved cells. Ordinary autolytic enzymes resemble trypsin at least in the major effects produced and trypsin has the power of decomposing nucleoproteids only to the extent of splitting off the proteid groups, leaving the nucleic acid in a free state. Apparently, the leucocytes contain nucleic acid splitting enzymes. In infarcts the intracellular proteolytic enzymes seem to attack the proteid structure of the cell but little and very slowly, except in the center of large necrosed areas. It would seem that this depends chiefly upon the presence in the blood plasma of antibodies or of some heat-susceptible substances which check the action of the autolytic enzymes. Possibly the alkalinity of the plasma also exerts a retarding influence. Chemotactic substances do not seem to be formed in aseptic dead tissues; indeed, the absence of leucocytic infiltration is so marked that it seems possible that substances with a negative chemotactic effect are present such as lactic acid, which is known to be formed during autolysis. The slow absorption of infarcts, etc., seems

to be accomplished almost entirely through a digestive action of the leucocytes acting slowly from the periphery.

F. P. UNDERHILL.

**A New Toxic Action of Horse Serum.** By M. J. ROSENAU AND JOHN F. ANDERSON. *J. Med. Research* **15** (New Series 10), 179-209. See also *Bull. 29 Hyg. Lab. U. S. Pub. Health and Mar. Hosp. Serv. Wash.* pp. 7-96.—Normal horse serum, when injected into the peritoneal cavity of a normal guinea pig, produces no symptoms. When injected subcutaneously there may result at most a slight local reaction, consisting of swelling and edema, which gradually disappears. Antitoxic serum is equally harmless for normal guinea pigs. Horse serum is, however, poisonous to a guinea pig which has previously been injected with horse serum. The "period of incubation" or time necessary to elapse between the first and second injection is about ten days. Under these circumstances horse serum is poisonous whether injected subcutaneously or into the peritoneal cavity. The first injection of horse serum renders the guinea pig susceptible. The symptoms caused by the injection of horse serum into a susceptible guinea pig are respiratory embarrassment, paralysis, and convulsions, followed by death. The symptoms come on usually within ten minutes after the injection, and when death results it usually occurs within an hour, frequently in less than thirty minutes and sometimes within a few minutes. The poisonous principle in horse serum appears to act upon the respiratory centers. The heart continues to beat long after respiration ceases. The toxic action of horse serum bears no relation to diphtheria. The poison is not toxone. Guinea pigs can not be rendered susceptible by previous injections with the *B. diphtheriae* or by previous injections with diphtheria toxine. It seems, however, that guinea pigs first injected with a mixture of diphtheria toxine plus horse serum are more sensitive to subsequent injections of horse serum than are guinea pigs sensitized with a first injection of horse serum alone. Diphtheria antitoxin plays no part in this poisonous action and in itself is harmless.

F. P. UNDERHILL.

**On the Chemical Conditions for the Heart Activity, with Special Reference to the Heart of Limulus.** By A. J. CARLSON. *Am. J. Physiol.* **16**, 378-409.—When the heart ganglion of *Limulus* is placed in isotonic solutions of cane-sugar, *d*-glucose, *δ*-*l*-fructose or lactose the rhythm is primarily augmented both in rate and in intensity. The augmentation may be accompanied by irregularity in the rhythm or the irregularity may first appear at the stage where the augmentation is followed by depression. The depression of the rhythm is gradual till after a fifty to ninety minutes' bath in the sugar solution, the rate of the nervous dis-

charges from the ganglion is much slower than prior to the sugar bath, and the intensity of the nervous discharges too feeble to produce contractions in the muscle. Only vigorous ganglia maintain their rhythm for that length of time in a pure sugar solution. Feeble ganglia, that is, ganglia exhibiting for some reason a weak and irregular rhythm, are brought to a standstill in a pure sugar solution within ten to twenty minutes. There appears to be no difference in the quality and intensity of action of the different sugars employed. When these isotonic sugar solutions are applied to the muscle in such a manner that the ganglion is not affected, the amplitude of the contraction is diminished without any primary augmentation. Isotonic solutions of urea and glycerol act on the heart ganglion in a way similar to the isotonic sugar solutions, only the action is more rapid and intense. The action of urea and glycerol on the heart muscle is the same as that of the sugar solutions. It is shown that isotonic solutions of either of the inorganic salts of the blood bring the ganglion to a standstill without killing the tissue, that is, after such a standstill the rhythm of the ganglion may be restored by plasma or sea-water. The sodium, potassium and ammonium salts in concentrations above that of the blood up to 0.6 N augment the ganglionic rhythm prior to the standstill, the potassium salts being the more powerful stimulants and at the same time the more injurious to the ganglion. In similar concentrations the salts of calcium and magnesium depress the ganglionic rhythm without primary stimulation. The salts of calcium, magnesium, potassium and ammonium depress the heart muscle without primary stimulation. The sodium salts produce primarily a slight augmentation in the strength of the contractions. The salts of sodium, calcium and magnesium have primarily the same influence on the heart muscle and the heart ganglion while the potassium and the ammonium salts produce qualitatively different effects on the two heart tissues. Acids have a primary stimulating action on the ganglion and a primary depressant action on the muscle. Sodium and potassium hydroxides stimulate the heart ganglion as well as the heart muscle of *Limulus*.

F. P. UNDERHILL.

**The Nutritive Requirements of the Body.** BY FRANCIS GANO BENEDICT. *Am. J. Physiol.* 16, 409-438.—The conclusion drawn from this article is that while the experiments of Siven, Hirschfeld, Folin, Caspari, and more especially Chittenden, threw most important light upon the metabolism of nitrogenous material in the body, the evidence they present is far from sufficient to assert that the amounts of protein ordinarily consumed should be permanently and materially diminished. On the contrary, the evidence set forth here would favor the view that permanent reductions are decidedly disadvantageous and indeed



not without possible danger. Furthermore, in the light of experimental evidence obtained with subjects in the respiration calorimeter and the fact that the law of the conservation of energy obtains in the human body, it follows that energy intake can be diminished only as energy output or muscular activity is diminished. These facts make any proposition to lower food consumption unaccompanied by decreased muscular activity impracticable.

F. P. UNDERHILL.

**Adrenaline Glycosuria, and the Influence of Adrenaline upon Nitrogenous Metabolism.** BY FRANK P. UNDERHILL AND OLIVER E. CLOSSON. *Am. J. Physiol.* **17**, 44-55.—Injection of adrenaline into the dog is followed by no alteration in the distribution of the nitrogen in the forms of ammonia nitrogen, urea nitrogen and creatinine nitrogen. The results of Paton in which the ammonia nitrogen of the urine was increased and the urea nitrogen decreased have not been confirmed. The ability of the organism to utilize glucose subcutaneously administered in adrenaline glycosuria is not seriously impaired. Repeated doses of adrenaline finally fail to produce glycosuria, thus giving evidence of the establishment of a certain tolerance, as already noted by other investigators. It is suggested that the mechanism of adrenaline glycosuria is essentially of nervous origin, and acts through the intermediation of the sympathetic nervous system which is called into play. This activity is in part directed upon the sugar-storing organs, causing them either to relinquish their supply of glucose-producing substances, or preventing the storage of glycogen, owing to the stimulation of the cells, or both, thereby causing hyperglycemia and glycosuria. Adrenaline glycosuria bears no relation to ordinary diabetes in man.

F. P. UNDERHILL.

**Experiments on the Physiological Action and Metabolism of Anhydro-oxymethylene-diphosphoric Acid (Phytin Acid).**

BY LAFAYETTE B. MENDEL AND FRANK P. UNDERHILL. *Am. J. Physiol.* **17**, 75-89.—A solution of anhydro-oxymethylene-diphosphoric acid, the acid radical of phytin, prepared from wheat bran, appears to be quite stable. When present in sufficient concentration, the acid inhibits the growth of bacteria. The salts of the acid are not noticeably bactericidal. Comparatively large doses of the phospho-organic acid, used as the sodium salt, can be introduced into animals either per os, subcutaneously, intraperitoneally or intravenously, without unfavorable effects. The free acid is more toxic. No marked or immediate characteristic effects of the sodium salt upon general health or nitrogenous metabolism have been observed. The compound is readily absorbed and speedily transformed within the organism. Its phosphorus reappears in the excreta as inorganic phosphates.

No constant relation between the metabolism of nitrogen and phosphorus was observed. These results with the dog correspond with the observations of Jordan, Hart and Patten (*Am. J. Physiol.* **16**, 268) after feeding phytin to cattle. The results differ in showing that in both the dog and rabbit the excess of phosphorus was almost entirely eliminated through the kidneys rather than in the feces. This may have an important bearing on the possibility of producing laxative effects with phytin. In the experimental animals purgative action could not be constantly provoked. Very large doses were frequently effective. No permanent generalizations can be drawn from the observations made on this point. F. P. UNDERHILL.

**Intestinal Gases of Man.** By J. AUGUST FRIES. *Am. J. Physiol.* **16**, 468-475.—Living on a very plain and moderate diet man discharges on an average about one liter of practically odorless gases from the rectum. The composition of these gases is as follows: Carbon dioxide, 10.3 per cent.; oxygen, 0.7 per cent.; Marsh gas, 29.6 per cent.; nitrogen, 59.4 per cent., the percentages being calculated by volume. F. P. UNDERHILL.

**The Rate of Diffusion of the Inorganic Salts of the Blood into Solutions of Non-Electrolytes and Its Bearing on the Theories of the Immediate Stimulus to the Heart Rhythm.** By WILLEY DENIS. *Am. J. Physiol.* **17**, 35-42.—There is a more rapid rate of diffusion of the primarily stimulating salts, sodium chloride and potassium chloride, as compared to the rate of diffusion of the depressor salts, *viz.*, the chlorides of calcium and magnesium, which would suggest that the stoppage of the Limulus heart ganglia in isotonic solutions of non-electrolytes may in part be due to the relatively greater concentration of the salts of calcium and magnesium in the cells and intracellular spaces.

F. P. UNDERHILL.

**The Reactions of Earth-worms to Salts; a Study in Proto-plasmic Stimulation as a Basis of Interpreting the Sense of Taste.** By G. H. PARKER AND C. R. METCALF. *Am. J. Physiol.* **17**, 55-75.—*Allolobophora foetida* withdraws from solutions of the chlorides of sodium, ammonium, lithium and potassium, varying in strength from mol. to  $\frac{m}{500}$  at rates that show these salts to be stimulating in the sequence (beginning with the most energetic) of sodium, ammonium, lithium and potassium. The worms withdraw quickly from distilled water that gives no evidence of olegodynamic action. *Allolobophora* is stimulated in part by the physical action of the salt solutions (osmotic pressure, diffusion, etc.), in part possibly by the chlorine anions (but of this there was no conclusive evidence), and principally by the cations sodium,

ammonium, lithium and potassium. The differential stimulation depends not upon valence or the sign of the electric charge, but upon the specific character of the cations. To man all four solutions taste salty but with slight characteristic differences; the salty taste is due to the anion chlorine, the characteristic flavor to the cations sodium, ammonium, lithium and potassium. In *Allolobophora* the chief stimulus is the cation, in man the anion; hence, the gustatory protoplasm of these two organisms must be chemically differentiated in these two directions. In the manure-inhabiting *Allolobophora* the four solutions are stimulating in the order sodium, ammonium, lithium and potassium; in the earth-inhabiting *Helodrilus* the same solutions are stimulating in the order potassium, ammonium, sodium and lithium; hence, these reactions are indicative of a probable adaptation of the gustatory protoplasm of their worms to their own chemical environments. The reactions of *Allolobophora* to solutions of sodium chloride are not influenced by solutions of calcium in such a way as to show that the sapidity of sodium chloride is related in any close way with its well-known toxicity.

F. P. UNDERHILL.

**Analogies of Phosphorized Fats Obtained from the Brain and Kidney.** BY EDWARD K. DUNHAM. *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.—Substances closely related to the lipoids derived from the brain may be obtained by similar methods from the kidney.

F. P. UNDERHILL.

**Toxicity of Indole.** BY A. N. RICHARDS AND JOHN HOWLAND. *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.—If the capacity of the animal cells of utilizing oxygen is diminished by potassium cyanide, or chloroform and indole administered subcutaneously, a series of symptoms results which ends after a period of days with the death of the animal.

F. P. UNDERHILL.

**The Formation of Urea.** BY L. B. STOOKEY AND A. S. GRANGER. *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.—Subcutaneous injection of liver extracts (dog) was found to lead, in the dog, to an increased elaboration of nitrogenous end products into urea. Liver extracts heated to 55° were not found to possess this stimulation. These results might indicate an enzymatic formation of urea.

F. P. UNDERHILL.

**The Effect of Choral Hydrate upon the Properties of Heart Muscle.** BY W. H. SCHULTZ. *Am. J. Physiol.* 16, 482-502.—The ventricular muscle of the frog or terrapin when dosed with chloral hydrate shows a gradual diminution in contractility. During the earlier stages of the poisoning the irritability in-



creases, after which it gradually diminishes. The spontaneous beats become weaker and finally disappear. Eventually the muscle loses all irritability to the strongest induction shocks. During the progressive stages of the poisoning the refractory period is at first somewhat shortened, so that the muscle becomes irritable to artificial stimulation toward the end of systole. At a certain stage in the poisoning the heart muscle, when stimulated by two successive shocks, exhibits the phenomenon of summated contractions and gives on repeated stimulation a curve resembling that of incomplete tetanus of skeletal muscle. The maximum shortening reached by these so-called compound contractions is always less than that shown by the normal single contractions of the unpoisoned muscle. Similar phenomena of summated contractions and compound contractions resembling tetanus may be obtained from heart muscle; that is, cooled to near zero, whether treated with ether, or when treated with an excess of calcium. The characteristic properties of the heart muscle are not lost as a result of the action of chloral hydrate. A definite refractory period remains, and the all or none law holds true at the time when the heart shows the characteristic effects of the poisoning, such as complete loss of spontaneous beats and the appearance of the phenomena of summated contractions.

F. P. UNDERHILL.

**On the Digestion of Gelatin.** BY P. A. LEVENE AND W. A. BEATTY. *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-162.—A hydrolysis of gelatin by means of strong hydrochloric acid, glycocoll, alanine, leucine, aspartic and glutamic acids, phenylalanine, proline and oxyproline and a few substances of undefined nature were obtained. On tryptic digestion a substance of the composition  $C_7H_{10}N_2O_2$  was isolated. On further hydrolysis this substance yielded proline and glycocoll. The substance was evidently prolinglycyl anhydride.

F. P. UNDERHILL.

**The Reaction of Amphioxas to Light.** BY G. H. PARKER. *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-162.—Amphioxas is negatively photodynamic and negatively phototropic.

F. P. UNDERHILL.

**Some Remarks on the Proposition that Thudicum's Phrenosin and Thierfelder's Cerebron Were Identical.** BY WILLIAM J. GIES. *J. Biol. Chem.* 2, 159-182. Also *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.—It is probable that phrenosin and cerebron are identical substances.

F. P. UNDERHILL.

**On the Action of Lipase.** BY ALONZO ENGLEBERT TAYLOR. *J. Biol. Chem.*, pp. 87-105.—Lipase, from castor bean, acts as a pure

catalyzer. In the fermentation of triacetin by lipase the transformation in the unit of time is proportional to the mass of the substrate. The influence of increase of temperature on the velocity of the lipase fermentation of triacetin was tested by the use of the empirical formula of van't Hoff,

$$\frac{\text{Velocity at } T_{n+10}}{\text{Velocity at } T_n} = 2 + .$$

With temperatures at 18° and 28° the average of several series was 2.6. The velocity of the lipase reaction is a function of time.

F. P. UNDERHILL.

### **The Relation of Ions to Contractile Processes. I. The Action of Salt Solutions on the Ciliated Epithelium of *Mytilus Edulis*.**

BY RALPH S. LILLIE. *Am. J. Physiol.* **17**, 89-142.—The injurious action of pure solutions of most sodium salts on the ciliated epithelium of *Mytilus edulis* may be counteracted by the addition of salts of certain metals (*e. g.*,  $\text{MgCl}_2$ ) to a degree varying with the nature of the anion of the sodium salt. Salts with the more toxic anions (sodium iodide, sulphocyanate, bromate, etc.) admit of relatively slight counteraction. Anions may thus be ranged in the order of their toxicity. This antitoxic action is well marked with lithium and sodium salts; slight or absent in ammonium and potassium salts. Anti-toxic action in solutions of sodium salts depends on the cation of the added antitoxic salt; the most effective antitoxic salts are those of bivalent metals whose cations have high decomposition tensions (alkali earth metals and manganese); heavy metals are less effective;  $\text{Fe}''$ ,  $\text{Co}$ ,  $\text{Ni}$ ,  $\text{Zn}$ ,  $\text{Cd}$ ,  $\text{Pb}$  show diminishing effectiveness in this order;  $\text{Cu}$ ,  $\text{Hg}$ ,  $\text{NO}_2$  are without favorable action. Acid (the hydrogen-ion) shows well defined antitoxic action with a large number of sodium salts: in general, the more toxic the anion of the sodium salt the more hydrogen-ions (or other antitoxic cations) are needed for optimum antitoxic action. Trivalent and tetravalent cations ( $\text{Al}$ ,  $\text{Cr}$ ,  $\text{Fe}'''$ ,  $\text{Th}$ ,  $\text{Sn}^{\text{iv}}$ ) exercise antitoxic action in much lower dilution than bivalent cations;  $\text{Al}$ ,  $\text{Cr}$  and  $\text{Fe}'''$  show optimum action in increasingly dilute solutions in this order;  $\text{Th}$  and  $\text{Sn}^{\text{iv}}$  resemble  $\text{Fe}'''$  in their dilution relations. The individual anions show a specific activity in producing swelling of cells in isotonic solutions of potassium and sodium salts. The order of increasing toxicity of the monovalent anions corresponds with the order of increasing activity in furthering absorption of water. This order is:  $\text{COOCH}_3$ ,  $\text{Cl}$ ,  $\text{NO}_3$ ,  $\text{ClO}_3$ ,  $\text{Br}$ ,  $\text{I}$ ,  $\text{CNS}$ ,  $\text{BrO}_3$ ,  $\text{OH}$ . The plurivalent anions in general show little activity in producing swelling. Antitoxic action with solutions of sodium salts appears to depend largely on the action of the antitoxic cation in retarding the swelling or disintegrative action due to preponderant anion action. The favorable action thus depends

largely on the production of an approximate balance between the opposed actions of anion and cation. In solutions of  $\text{SrCl}_2$  a relation appears between antitoxic action and the anticoagulative action of the antitoxic salt; the action is due to the checking of a preponderant cation or coagulative action; salts with active anions thus show antitoxic action ( $\text{NaOH}$ ,  $\text{KCN}$ ,  $\text{Na}_2\text{HAsO}_4$ ,  $\text{NaBr}$ ,  $\text{NaI}$ ,  $\text{NaCNS}$ ). Other alkali earth chlorides show similar relations. In general, antitoxic action seems due to an approximate equalization of the opposite actions of anion and cation on the colloids of the tissue. Hence, salts whose toxicity is due to predominant anion action require salts with active cations for counteraction and *vice versa*.  
F. P. UNDERHILL.

**The Cleavage Products of Vitellin.** BY P. A. LEVENE AND C. L. ALSBERG. *J. Biol. Chem.* **2**, 127-134.—Vitellin was decomposed by means of hydrolysis with hydrochloric acid and the decomposition products separated by a modified Fischer method. Calculated for 100 grams of vitellin the yield of the constituents was as follows: Glycocoll, trace; alanine, 0.16 gram; leucine, 3.30 grams; proline, 4.00 grams; aspartic acid, 0.60 gram; glutamic acid, 1.0 gram; phenylalanine, 1.0 gram; tyrosine, 0.40 gram; histidine, trace; arginine, 1.20 grams; lysine, 2.40 grams.

F. P. UNDERHILL.

**Some Observations on the Presence of Albumin in Bile.** BY WILLIAM SALANT. *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series **1**), 152-161.—Albuminocholia, after poisoning with ethyl or amyl alcohol, may be due to inflammation of the gall bladder. Albumin appears to pass into the urine more readily than into the bile.

F. P. UNDERHILL.

**Mucoid Salts.** BY WILLIAM J. GIES. *J. Am. Med. Assoc.* **47**, 560; also *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series **1**), 152-161.—Author shows that mucoids may form salts with various inorganic salts. These inorganic salts of the mucoids are light snow-white powders. They dissolve in water very readily and are dissociable products. The concentrated solutions resemble mucus. The aqueous solutions are neutral to litmus and acid to phenolphthalein. Ammonium compounds have been prepared that were acid to litmus also. The calcium salt yields about 12 per cent. of ash, whereas the corresponding mucoid is practically ash-free.

F. P. UNDERHILL.

**Albuminuria: Recognition of the Albumin-Bodies of the Urine.** BY T. W. HASTINGS. *N. Y. Med. Record*, **70**, 13-19.—Many of the albumin bodies which theoretically might occur in urine may be excluded from consideration for various reasons: serum albumin, nucleo-albumin, serum globulin and Bence-Jones albumose should be considered. For purposes of excluding false reactions



due to bacterial disintegration, the urine should be examined within six hours after voiding, unless the reaction is massive. The most reliable test for serum-albumin in urine is that of "salting" the urine with a saturated solution of sodium chloride, acidulating with 50 per cent. acetic acid, and heating to boiling; this throws down all traces of serum-albumin and prevents a nucleo-albumin reaction.

F. P. UNDERHILL.

**Solution of Tissue and Abscess.** BY EUGENE L. OPIE. *J. Expt. Med.* 8, 536-542.—Leuco-proteose is capable of causing proteolysis in the presence of turpentine, and the power of blood serum to inhibit this digestion is unaffected by turpentine. It is not improbable that an increasing quantity of proteolytic enzymes set free by disintegration of polynuclear leucocytes has so far overcome the anti-enzymotic action of a limited quantity of exuded serum that the entire pus is capable of active autolysis and has the power of digesting foreign proteid. The limited ability of a given quantity of blood serum to inhibit the action of increasing quantities of enzyme gives confirmation of this view. A purulent exudate is characterized by its ability to dissolve fibrin and necrotic tissue because its serum, unlike that of the non-purulent exudate, does not check the activity of the proteolytic enzyme furnished in great abundance by the polynuclear leucocytes.

F. P. UNDERHILL.

**The Influence of Colloids upon the Diffusion of Hemolysins.** BY SIMON FLEXNER AND HIDEYO NOGUCHI. *J. Expt. Med.* 8, 547-564; also *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.—Acids, alkalies, salts, glucosides and certain toxins diffuse more quickly into 0.9 per cent. salt solution than into agar-agar or gelatin suspensions. The inhibitory effect of the colloids grows with increase in concentration, which increase affects both the velocity and extent of the diffusion. Hemolytic substances diffuse from gelatin into agar-agar more slowly than from saline into agar-agar. But the velocity of diffusion from agar-agar into gelatin is greater than from saline into gelatin. The effects of differences in concentration of the hemolytic agent vary according to the agent and the manner of its solution. When the hemolyzer is dissolved in salt solution the diffusion of 1/100 N and 1/1000 N solutions (saponin) is almost identical, while with solanin the stronger solutions diffuse faster. When the hemolyzer is dissolved in the colloid, diffusion into fluid media is nearly proportional to the concentrations of the hemolytic agent. The velocity of diffusion into and from colloids is in general proportional to the square root of the time. Acids, alkalies, salts and glucosides act in a manner which is in agreement with this rule. Cobra lysin and tetanolsin do not act in conformity with the rule. Cobra lysin appears to diffuse

into colloids more slowly, proportionally, than cobra neurotoxin, tetanospasmin more slowly than tetanolysin. The biological method described in this paper for studying diffusion in colloids is applicable to hemolytic and some other toxic substances. Since all diffusions in the body take place within colloidal media of different concentrations, it would appear desirable to perfect methods through which the interaction of toxic chemicals and the fluids and cells of the body may in a manner be imitated *in vitro*.

F. P. UNDERHILL.

**The Influence of Subcutaneous Injections of Dextrose upon Nitrogenous Metabolism.**

BY FRANK P. UNDERHILL AND OLIVER E. CLOSSON. *J. Biol. Chem.* 2, 117-127; also *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.—No evidence has been obtained that large quantities of glucose subcutaneously administered to the dog exert a toxic action resulting in changes in the urinary forms of nitrogen. The conclusion of Scott that glucose may thus act like phosphorus, etc., by poisoning the protoplasm has not been substantiated. The results of Scott are attributed in part to ammoniacal fermentation induced in the urine of his experimental animals, and also to errors which have crept into his work. The present experiments also demonstrate the great power of the animal body to utilize glucose given subcutaneously.

F. P. UNDERHILL.

**A Colloidal Compound of Strychnine and Its Pharmacology.**

BY ORVILLE HARRY BROWN. *J. Biol. Chem.* 2, 149-158; see also *Am. J. Physiol.* 15, 22; Abstract, this Review.—A mixture of hydrogen dioxide, albumin and strychnine will undergo in the course of about six weeks' time a change in which the previously thin watery fluid is transformed into a jelly or throws down a white flocculent precipitate. Neither of the results occurs, if water is substituted for either the hydrogen dioxide or the albumin. Neither does the jelly or precipitate form, if other antiseptic solutions, as hydrochloric acid or thymol, are substituted for hydrogen peroxide. If adrenaline chloride is substituted for the strychnine, a jelly is having the same appearance as is the case with strychnine. The fact that adrenaline does not turn a pinkish color in the mixture with albumin and hydrogen dioxide as it does with hydrogen dioxide alone is significant that a chemical combination between the adrenaline and albumin is formed in the presence of hydrogen dioxide. It appears that any salt or alkaloid and probably other chemical substances as well will form a jelly or precipitate when mixed with albumin and hydrogen dioxide. Yolk of egg or organ extracts may be substituted for the albumin in this mixture with the formation of a similar jelly. The presence of organic material with strychnine is very likely to mask the chemical tests for it. The administration (frog, rabbit)

of an amount of this jell which contains many times a lethal dose of strychnine produces tetanus only after four or five hours. The strychnine mixed with either albumin or hydrogen dioxide alone produces its effects in three to five minutes. An amount of this jell containing thirty times a lethal dose of pure strychnine may be given a rabbit subcutaneously without producing toxic effects. The same dose if administered per stomach produces death in a little over three hours. The strychnine is not oxidized by the hydrogen dioxide. The strychnine of the mixture is in some way chemically fixed by the albumin so that its effects are not obtained when introduced into the body until after the alkaloid is separated from the albumin by digestion.

F. P. UNDERHILL.

**On Bacterial Processes in the Intestinal Tract in Some Cases of Advanced Anemia, with Especial Reference to Infection with *B. Aerogenes Capsulatus* (*B. Welchii*).** BY C. A. HERTER. *J. Biol. Chem.* 2, 1-71; also *Proc. Soc. Expt. Biol. and Med. Am. Med.* (New Series 1), 152-161.—The human intestine of normal adults and of normal children frequently holds small numbers of the anaerobic, difficultly spore-forming, gas-making bacillus described by Welch and Nuttall as *B. aerogenes capsulatus*. In some conditions of disease the intestinal tract shows the presence of anaerobic, difficultly spore-forming, gas-making bacilli, identical with *B. aerogenes capsulatus* in greatly increased numbers. The presence of *B. aerogenes capsulatus* in excessive numbers in the feces is determinable by plating in sugar-blood agar, by the inoculation of sterilized milk in fermentation tubes, by the procedure of intravenous infusions of fecal suspensions into rabbits and subsequent incubation, and by the microscopical examination of the grain-stained fecal fields. The infection of the intestinal tract with *B. aerogenes capsulatus* leads to varying clinical results. In many acute and subacute capsulatus infections of the intestine the living micro-organisms of the *B. coli* type in the feces are much reduced in number. *B. aerogenes capsulatus* is prominently characterized by the ability to induce a characteristic type of putrefactive decomposition which may be designated as saccharo-butyric putrefaction. Among the chief products of saccharo-butyric putrefaction are carbon dioxide, hydrogen, butyric acid and ammonia. This putrefaction may occur in proteid media containing very little carbohydrate material. The excessive formation of gas and the consequent flatulence in many cases of capsulatus infection of the intestine are referable to excessive saccharo-butyric putrefaction or fermentation. The excess of higher volatile fatty acids including butyric which is observed in many cases of capsulatus infection is referable to excessive saccharo-butyric putrefaction. *B. aerogenes capsulatus* is an active hemolyzing agent. The haemolysis induced by it in



*vitro* can probably be referred in part, but only in part, to the formation of ammonium butyrate. The close association between certain anemias and capsulatus infection of the gastro-enteric tract creates a presumption that this infection stands in a causative relation to these anemias, although experimental evidence of such a relation has not yet been obtained.

F. P. UNDERHILL.

**Studies on Putrefaction.** BY LEO F. RETTGER. *J. Biol. Chem.* 2, 71-87.—Putrefaction is the work of anaerobes, and of all the organisms examined thus far, of strict anaerobes only. The best known of the putrefactive anaerobes are *B. putrificus*, the bacillus of malignant oedema and the bacillus of symptomatic anthrax. Egg-meat mixture and blood fibrin are readily decomposed by them, yielding the foul-smelling products that are so characteristic of real putrefaction, particularly mercaptan. In pure cultures of these organisms, however, indole, skatole and phenol are not produced or only in minute quantities. Except in very rare instances putrefactive organisms of the above type have not been observed in feces either of normal persons or of those suffering with pernicious anemia, even when the stools had a decidedly offensive odor. In the large majority of cases, however, feces have a more or less putrefactive action on the egg-meat mixture, sometimes causing a reduction of the bulk of the proteid of from 25-30 per cent. This action is most pronounced as a rule after heating the tubes for ten minutes at 80°. The *Bacillus enteritidis sporegenes* of Klein is regularly present in human feces, and although commonly regarded as being a purely fermentative organism it may be at least partly responsible for putrefactive changes in the intestine. The observations recorded in this paper strongly support the view of Bienstock that the *Bacillus coli communis* and *Bacillus lactis aerogenes* are not harmful inhabitants of the intestine but that their function is a protective one. Their presence in any putrefying medium is a hindrance to the work of the putrefactive bacteria and therefore serves as a check on their activities. F. P. UNDERHILL.

**The Practical Significance of a Trace of Albumin in the Urine.** BY J. P. TUNIS. *Am. J. Med. Sci.* 132, 67-77.—From any point of view the term "physiological albuminuria" is almost universally regarded as misleading, unsatisfactory and inadequate. As long as albumin is a constituent of the urine the individual voiding it cannot be regarded as normal. For practical purposes the heat and nitric acid test for albumin is the best one, and the careful use of Roberts' solution the most satisfactory control test in doubtful cases. F. P. UNDERHILL.

**A Contribution to the Chemistry of the Bacterial Cell and a Study of the Effects of Some of the Split Products on Animals.**

BY VICTOR C. VAUGHAN. *Bost. Med. Surg. J.* **155**, 215-222, 243-247, 271-276.—The cellular substance of the colon bacillus, after being freed from all matter held by it and in it mechanically, consists of a complex chemical compound composed of chemical nuclei with numerous attached groups or side chains. The chemical nucleus or center of chemism is contained in a "crude soluble poison" extracted by author. When the cellular molecule is split up by means of an alcoholic solution of sodium hydroxide, the molecular nucleus is found in that fraction which is soluble in alcohol. Since similar "soluble poisons" have been obtained from other bacteria and from egg albumin and peptone the author concludes that the chemical nucleus in all these bodies is similar but not identical. The chemical nucleus has great affinity for other substances containing groups from which it can detach side chains and for this reason is an active cell poison. The *modus operandi* of the chemical nucleus as a poison is explainable by its detaching from certain cell molecules of the animal body side chains upon which the functioning of the animal cell depends. The intensity of the poisonous action of the chemical nucleus depends in the first place upon the intensity of its chemism and in the second place upon the number and condition of its receptors. The chemical nucleus of all the bacterial cells studied as well as that of egg albumin and peptone appears to have a special affinity for certain side chains in the cell molecules of the respiratory centre of the animal. It tears off these side chains from the cell molecules of the respiratory centre, thus interrupting the functions of these cells and causing the death of the animal. It is probable that the chemical nucleus of every foreign cell and every foreign proteid as well when brought into the circulation in a free state is more or less of a poison to the respiratory center. Whether a given proteid will prove poisonous to an animal or not when introduced into the blood directly by intravenous injection or indirectly by subcutaneous injection depends upon whether or not its chemical nucleus is set free intact and upon the rapidity with which it is set free. The chemical nucleus of a cell or a proteid does not absolutely destroy the cells of the animal body. It tears off their side chains, and impairs or interrupts their functions. The chemical nucleus of the colon bacillus, when administered by the alimentary canal or when introduced into the abdominal cavity enclosed in a collodion sac, diffuses so slowly that it does not visibly affect the animal. It is also, in part at least, destroyed in the intestine when taken by the mouth. Furthermore, it is possible that the chemical nucleus even of the proteid foods largely passes through the alimentary canal and is not absorbed at all. When the chemical nucleus is broken up, its constituents are not poisonous. The chemical compound of which the essential part of the colon

bacillus is composed is not a poison, or at least not an active poison until it is disintegrated by the aggressive action of the cell molecules of the animal body. Various facts show that the soluble poison obtained by splitting up the colon cell is the poison that kills when an animal is inoculated with a living culture.

F. P. UNDERHILL.

**On the Comparison of Conductivity and Freezing-Points of Small Quantities of Body Fluids in Health and Disease.** By THOS. M. WILSON. *Am. J. Physiol.* **16**, 438-468.—The electrical method of freezing small quantities is adapted for a physical laboratory but not for clinical purposes. The freezing-point of 0.3 cc. of salt solution can be determined with a fair degree of accuracy when mercury is added to make the volume sufficient to cover the greater part of the Beckmann bulb. The inoculation method must be used in all determinations with small quantities. When the volume of fluid reaches 0.8 cc. the mercury may be discarded and determinations made without it. Blood serum and blood cannot be mixed with mercury in determinations of the freezing-point, since an emulsion so readily forms and spoils the results. Not less than 0.8 cc. of blood or serum can be accurately frozen for the reason given above. The composition of the organic bodies and inorganic salts of the serum harmonizes with six facts about serum: (1) It represents closely the total weight of the formed bodies in serum. (2) It represents the total alkalinity as far as this can be accurately shown. (3) It accounts almost exactly for the five chief elements found in the salts of serum. (4) It gives the right percentage of sodium chloride. (5) When the percentages of the salts are reduced 2 per cent. it gives the proper freezing-point, *i. e.*,  $0.566^{\circ}$ . (6) It gives the proper conductivity for normal serum, *i. e.*, 82. The improved micagocrite has been shown to give reliable results. Conductivity measurements are best made at  $18^{\circ}$ . The micagocrite tube can be used as an ordinary hematocrite tube. The freezing-point for gases in solution can be obtained from the equation  $\Delta = 8x(10)^{-5}$  where  $\Delta$  equals thousandths of a degree centigrade and  $x$  the number of cubic centimeters of gas dissolved in a little of solution. The freezing-point equivalent for conductivity of serum, increased 7 per cent., given in terms of sodium chloride, gives approximately the inorganic freezing-point of serum from healthy individuals. Its value is  $-0.490^{\circ}$ . The curves plotted are of clinical value in correlating  $\Delta$  and  $\lambda_s$  in terms of sodium chloride. By knowing the freezing-point of a solution, the gram-equivalent of an isotonic salt solution can be quickly ascertained, also its value in grams per 100 cc. by multiplying the gram-equivalent by 5.85. When the conductivity at  $5^{\circ}$  of a solution is known, its gram-equivalent and gram per 100 cc. can be likewise correlated to a sodium chloride solution. In cases of nephritis, pneumonia,



and anemias, information is obtained from conductivity and freezing determinations which appears to be of considerable diagnostic value. In other diseases, considerable knowledge is obtained which may help in the proper understanding of blood conditions.

F. P. UNDERHILL.

**On the Action of Chloral Hydrate on the Heart with Reference to the So-Called Physiological Properties of Heart Muscle.**

BY A. J. CARLSON. *Am. J. Physiol.* **17**, 1-8.—Chloral hydrate has a stimulating action on the heart ganglion of *Limulus*. When a solution of chloral hydrate is applied to the entire heart the heart tissues are ultimately paralyzed in the following order: Ganglion, nerves, nerve endings and muscle. These results are in accord with those obtained by Rohde (*Archiv. f. Expt. Path. u. Pharm.* **54**, 104 (1905)) and contrary to those of Howell (*J. Am. Med. Assn.* **46**, 1670 (1906)). See also Schultz (*Am. J. Physiol.* **16**, 483; Abstract, this Review).

F. P. UNDERHILL.

**The Influence of Osmotic Pressure on the Irritability of Skeletal Muscle.** BY WALTER J. MEEK. *Am. J. Physiol.* **17**, 8-15.—Hypertonicity depresses contractility and excitability without primary stimulation. In all cases perfusion with double strength Ringer's solution or Ringer's solution + isotonic cane-sugar diminishes the amplitude of the muscular contraction. Hypotonicity increases the excitability and contractility without primary depression. In all cases the effect of hypotonicity is the opposite of hypertonicity, that is, the height of the muscular contraction is increased. Curarized skeletal muscle gives the same reactions to hypotonicity and hypertonicity as uncurarized. The point of action is therefore on the muscle cells.

F. P. UNDERHILL.

**The Effect of Subcutaneous and Intravenous Injections of Some Saline Purgatives upon Intestinal Peristalsis and Purgation.**

BY JOHN AUER. *Am. J. Physiol.* **17**, 15-26.—The subcutaneous and intravenous injection of magnesium sulphate and chloride, sodium sulphate, phosphate and citrate does not produce purgation in rabbits. Applied in the same way, these substances, with the exception of magnesium salts, produce a moderate but definite increase in the peristalsis of parts of the gut. Magnesium salts injected subcutaneously or intravenously do not produce peristalsis in rabbits. The use of salines subcutaneously or intravenously in human therapeutics, as suggested by MacCallum (*Am. J. Physiol.* **10**, 109 (1903)) is not warranted by the experimental evidence. Peristalsis and purgation are not synonymous terms; increased peristalsis may occur during constipation and there may be no increased peristalsis during purgation.

F. P. UNDERHILL.

**The Composition of Bone in Osteomalacia.** By FRANCIS H. MCCRUDDEN. *Am. J. Physiol.* **17**, 32-35.—Analysis of two horse ribs which had been affected by the characteristic changes of osteomalacia shows that there is a decrease in the calcium content of the diseased bone and an increase in its magnesium content. There is also an increase in the sulphur content and decrease in the phosphorus content. The inorganic material of the bone as a whole is diminished in amount. From the analysis it is probable that in osteomalacia at least two processes occur in the diseased bone—the one an absorption of calcium and phosphorus, and the other an opposition of magnesium and of material, probably organic, which is rich in sulphur.

F. P. UNDERHILL.

**On the Influence of Neutral Salts upon the Rate of Salivary Digestion.** By JANE BOIT PATTEN AND PERCY G. STILES. *Am. J. Physiol.* **17**, 26-32.—Ptyalin does its work with surprising ease in the presence of many salts in high concentration. This is even the case with some saturated solutions, notably those of magnesium sulphate and ammonium chloride. The most striking accelerating effects were obtained with salts of magnesium, calcium and barium—belonging to a natural chemical group. With increasing concentration these salts diverge in their behavior, and calcium chloride at last restrains the enzyme, which never becomes true of magnesium sulphate. A comparison of the retarding influence of salts of ammonium, potassium and sodium shows the ammonium compound much less active in checking the digestion than either of the other two. Of the halogen compounds of potassium the chloride retards ptyalin action less than the bromide, which in turn retards less than the iodide. The fluoride distinctly accelerates the amylolytic at every stage up to saturation. Lithium chloride in moderate amounts checks the action of ptyalin almost as quickly as does copper sulphate. Experiments with Taka-diastrase show that it is in most cases even more resistant than ptyalin toward neutral salts.

F. P. UNDERHILL.

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## PHARMACEUTICAL CHEMISTRY.

**A Review of the Literature on the Estimation of Alkaloids for the Year 1905.** By W. A. PUCKNER. *Pharm. Review*, **24**, 228-238 (1906).—The author states that where practical, the Pharmacopoeia adopted the Keller method, as modified by himself. This combines maceration and percolation in place of using an aliquot portion of a volatile liquid. He finds a lack of coordination on the part of the subcommittees, *i. e.*, caffeine is described as a feebly basic substance with tests to indicate the presence of alkaloids, from which it appears that caffeine is not an

alkaloid, while 100 cc. of fluid extract of guarana is required to contain 3.5 grams of alkaloids. *Aconite*.—The author states that the method of A. B. Stevens is made official. The process is simple and decomposition is prevented by evaporation at a low temperature. Volumetric and gravimetric results obtained by this method agree closely, while those of other methods show wide variations. However, F. M. Francis thinks that the method fails to determine pure aconitine, and prefers Squibb's physiological method. *The Mydriatic Drugs*.—Here the Pharmacopoeia uses the author's modification of Keller's method, using ether-chloroform as a solvent. The direction to "shake the separator for half a minute" is liable to convey the impression that vigorous agitation is required; this should be avoided, as emulsions are liable to form. G. Fromme believes that ether should be substituted for ether-chloroform. The author states that Farr and Wright report the assay of 14 samples of belladonna root, minimum 0.31, maximum 0.64, average 0.44, and recommends a minimum standard of 0.4 per cent. Henderson considers this too high and reports seven assays, each from lots of 800 to 900 pounds with minimum 0.32, maximum 0.55, and that for some time root containing more than 0.3 per cent. was not obtainable. The author gives Thoms' method for the separation of atropine from volatile organic bases, which depends upon the precipitation of the alkaloid by potassium-bismuth iodide, collecting the precipitate, washing with 5 per cent. sulphuric acid and decomposing with a mixture of sodium carbonate and hydroxide, and shaking out with ether. *Cinchona*.—The author states that the official method is based upon Keller's method. The ether-chloroform solution is divided into two portions, one for the estimation of total alkaloids and the other for the estimation of the ether-soluble alkaloids. He states that the yield of total alkaloids is far below that obtained by other methods. The author states that S. C. Gadd proposes a modification of the British Pharmacopoeial method, in which the cinchona is triturated with lime and extracted with a mixture of benzin and amyl alcohol, shaken out with acidulated water, and the quinine and cinchonidine precipitated with sodium-potassium tartrate. From the filtrate the remainder of the alkaloids are precipitated by ammonia. The author states that Vigeron proposes to determine quinine by extracting with ether and crystallizing as sulphate, washing with a saturated solution of quinine sulphate and precipitating as chromate. Roberts proposes to determine the quinine by precipitating with ammonium sulphocyanate in the presence of zinc sulphate. *Coca*.—The author states that the method is practically the same as that used for the mydriatic drugs except that ether is used in place of chloroform. Francis reports 15 assays of Huanuco leaves ranging from 0.43 to 0.82



per cent. and 6 assays of Truxillo leaves from 0.46 to 0.83 per cent., also that the drug under most favorable conditions loses from 0.63 to 0.8 per cent. in six months. The method which Greshoff found superior to all others, is to extract the drug with hot alcohol, evaporate, dissolve in water, filter, extract the filtrate with ether, to remove wax and finally extract the alkaloid with ether, evaporate in a current of air and dry at 95°. *Coffee, Guarana, Kola, Etc.*—The author finds that the final addition of ether to remove chloroform is unnecessary, also that caffeine does not become anhydrous at 100°, even if continued for several days. He reports that Ballard estimates caffeine by adding magnesium oxide and extracting with hot water, evaporating to dryness, extracting with ether, evaporating and dissolving in water, to free from fats, and evaporating to dryness. *Colchicum.*—The author states that colchicine is easily saponified and that all of the methods are unsatisfactory. *Continued in Sept. No., 267-276.* *Conium.*—The author states that the results obtained by assay of conium are not satisfactory, as the yield of conium chloride from a standard drug is less than 0.033, therefore the retention of a small amount of fat would cause a large error, or the results may be low from loss by evaporation of the free alkaloid through faulty manipulation. *Gelsemium.*—Here the author gives Sayer's method from American Pharmaceutical Association, 53, 282. *Hydrastis.*—The author calls attention to the fact that in the method for the drug the separation of hydrastine from berberine depends upon the slight solubility of berberine in ether, while in the assay of the preparations, the berberine is more completely removed as iodide by Gordin and Prescott's method. Hence the yield is proportionately less. *Ipecac.*—The author states that the U. S. P. gives the Keller method, and adds that the titration is unsatisfactory, due to the tendency of the ipecac alkaloids to discolor. Fromme overcomes this difficulty by dissolving the final residue in a mixture of 5 cc. absolute alcohol, 20 cc. ether and 10 cc. water, and titrates. Toward the end of the titration 30 cc. of water are added and the titration completed. *Nux Vomica.*—In this method the brucine is destroyed by oxidation with nitric acid according to Gordin's method. The author states that the wording of the method is not explicit enough for inexperienced workers. According to Howard, the results by Keller's oxidation method may be too high, or too low, depending upon conditions, but correct results may be obtained by keeping the temperature sufficiently low. Lenton prefers the ferrocyanide method of separation of strychnine from brucine, and states that the results by the nitric acid method are erratic and not comparable with those obtained by the ferrocyanide method. *Opium.*—The author states that the old method was retained, only modified by subtracting the im-

purities insoluble in lime water. This was a disappointment to many who were favorably impressed with the concordant results obtained by the Stevens method. Vanderkleed finds that increasing the ammonia water from 3.5 to 4 cc. increases the weight of crude morphine but that the increase is due to impure calcium meconate. Mallinckrodt and Dunlap found the meconates of the U. S. P. 1890 process to be calcium-ammonium meconate, which requires more acid for neutralization than an equivalent of morphine. A. and Albert Petit, appointed to report upon the current methods for determining morphine in opium, recommend the lime method for the next edition of the French Codex. *Physostigma*.—Beckurts states that calabar beans contain three alkaloids, physostigmine, eserine and calabarine, and that only the first two are soluble in ether. The insoluble calabarine has tetanic action. The method of the U. S. P. determines only the ether-soluble alkaloids. *Pilocarpus*.—A. B. Lyons's method is directed by the U. S. P. The drug is exhausted with chloroform in the presence of ammonia. Mann thinks that jaborandi should be assayed for pilocarpine instead of for total alkaloids, but Naylor does not know of a method that will determine within 5 per cent. of the amount of pilocarpine in the preparations of the drug. *Pomegranate*.—Fromme reports that the variable results obtained when determining the value of pomegranate are due to loss of the alkaloids by volatilization. A. B. STEVENS.

**Separation of Morphine from Its Solution in Glycerin.** By H. M. GORDIN. *Am. J. Pharm.* **78**, 464.—After trying several methods the author obtained the best results as follows: The solution is treated with an excess of normal iodine and diluted to three times its original volume, allowed to stand twelve hours and the morphine hydroiodide triiodide collected, washed with water containing a little Wagner's reagent, and dissolved in 10 per cent. sulphurous acid. Solution of potassium carbonate is added in excess, heated to 100° for two minutes, and allowed to stand until crystallization is complete. This method, however, only recovers 80 per cent. of the morphine taken.

A. B. STEVENS.

**Acetone Collodions.** By G. M. BARINGER. *Am. J. Pharm.* **78**, 470.—The author recommends the use of acetone for the manufacture of all official collodions except styptic collodion. He also adds 1 gram of camphor to four of pyroxylin, and claims that it is superior to official collodion or the flexible, and may well displace both.

A. B. STEVENS.

**Some Alkaloidal Assays.** By H. M. GORDIN. *Am. J. Pharm.* **78**, 458-463.—For the liberation of alkaloids in drug assays the author prefers sodium carbonate or hydroxide to ammonia, because ammonia is taken up by the ether, which must be dis-

tilled nearly to dryness to remove the last traces of ammonia. Ether alone takes up fixed alkalies but this can be prevented by using a mixture of three volumes of ether to one of chloroform or benzin. Illustrations of two separators are given: one with two separate stop-cocks, to avoid the necessity of drawing the ethereal and watery solutions from the same opening; the second is a slight modification of the Bremer separator so that it may be connected with a condenser and the solvent removed by distillation.

The author's method for the assay of aconite consists in shaking the drug with a mixture of ether and chloroform, 3:1, and 5 cc. of 10 per cent. sodium carbonate solution, percolating to exhaustion, filtering, evaporating to one-half to remove liberated ammonia, replacing the loss with ether, shaking out with standard acid and titrating. In the assay of ipecac the author uses the same method as for aconite, except that the first acid solution is made alkaline and shaken out with ether-chloroform before the addition of the standard acid. For fluid extracts of aconite, coca, belladonna and ipecac the author uses sodium carbonate and shakes out with ether two volumes, petroleum ether one volume, concentrates one-half, dilutes with ether, shakes out with standard acid and titrates. The same method is used for fluid extract of pilocarpus, except that potassium carbonate is used in place of sodium carbonate, and chloroform in place of benzin. For fluid extract of cinchona sodium hydroxide is used and the second acid solution is shaken out with chloroform, evaporated and weighed. A. B. STEVENS.

**Alkaloidal Assays of U. S. P.** BY H. M. GORDIN. *Am. J. Pharm.* 78, 453.—The author states that the methods for aconite and fluid extracts of aconite and ipecac are unworkable, because the first acid liquids are thick and will not filter as directed. (See preceding abstract. This difficulty may be prevented by adding pumice stone as directed in the original method by Stevens. *Pharm. Arch.* 6, 49, A. B. S.). The author states that belladonna leaves and root should be percolated to exhaustion as indicated by Wagner's reagent, and as these drugs are poor in alkaloids, at least 20 grams should be taken for the assay. Under cinchona he states that the directions should be to take 150 cc. of a mixture of 5 volumes ether to 1 of chloroform, as these liquids contract when mixed. If they are measured before mixing, the aliquot part will represent more than 10 grams. Coca should be exhausted as indicated, by Meyer's reagent. The author follows with a number of suggestions upon the assay of extracts and fluid extracts and recommends weighing extracts directly into the separator. A. B. STEVENS.

**Some Constituents of the Poison Ivy Plant.** BY S. F. ACREE



AND W. A. SYME. *Am. Chem. J.* **36**, 301-321.—The authors treated the ether extract of the plant with 50 per cent. alcohol and precipitated the solution with lead acetate. The precipitate was collected in six fractional parts, the last of which was lighter than the others. This was decomposed by hydrogen sulphide and extracted with ether but the residue was not poisonous. (By a somewhat similar method Pfaff found that the last fraction of the lead precipitate contained the poison.) In another experiment the authors extracted the entire lead precipitate with ether, which removed a dark poisonous substance, from which they separated a small quantity of solid yellow resin, which was poisonous. This they designated as *toxicodendrin*. They also obtained gallic acid, fisetin and rhamnase. These substances were also obtained by hydrolysis of the impure poisonous substance, from which they conclude that the poisonous body is split up into these substances. They found that all cases of poisoning were easily cured by potassium permanganate. The authors suggest the following method for obtaining the poison from the plant: "Extract the plant with alcohol, filter and precipitate at once with lead acetate. Wash the precipitate, and extract with ether in a loosely filled Soxhlet extractor. Combine the ether extracts, mix with water and pass in hydrogen sulphide. Separate the water and the ether solutions and filter the latter. Wash the ether solution thoroughly by shaking with water, then evaporate at a low temperature."

A. B. STEVENS.

## INDUSTRIAL CHEMISTRY.

**Pre-Heaters and Electric Furnaces.** Editorial. *Electrochem. and Met. Ind.* September, 1906, p. 340.—The cost of a heat unit of electrical energy is from 2 to 40 times that derived from coal.

With electrical energy at  $1\frac{1}{2}$  mills per horse-power hour, as found in French Alps and Norway, and coal at \$8 per ton, the ratio is 2. At 3 mills per horse-power hour and coal at \$2 per ton, the ratio is 15. With black coal at the mouth of the mine, the ratio is 40.

The efficiency of an electric furnace should be from 75 to 95 per cent., while that of heating or evaporation with coal is rarely as high as 75 per cent., and is frequently as low as 3 per cent.

S. S. SADTLER.

**Artificial Diamonds.** Editorial. *Electrochem. and Met. Ind.* September, 1906, pp. 341-342.—These results are those obtained by Dr. A. Ludwig, who found that when carbon resistance rods forming arcs, passing through a chamber in which there was a pressure of about 1,500 atmospheres maintained, and the heat

brought up in the rods, a peculiar phenomenon was manifest. The current was continually interrupted.

It was found that a vitreous form of carbon was formed, which caused an interruption of the current. As it cooled, due to the absence of the arc, this modification of carbon passed into graphite.

By maintaining an atmosphere of steam in the chamber, it was found that more or less of this vitreous form of carbon, or artificial diamond could be preserved. S. S. SADTLER.

**Factory Scale Experiments with Fused Electrolytes.** E. A. ASHCROFT. *Electrochem. and Met. Ind.* September, 1906, pp. 357-358.—A suitable electrolytic cell for the separation of metals in mixed ores is one in which molten lead is used as a cathode in a fused bath. If sulphur is present as sulphide, the sulphur distils off. The cathode is made to revolve by means of the action of lines of force from an electric circuit surrounding the cell.

In this way the surface of the cathode is kept clean, the cell is stirred, and light precipitated metals go to the centre and can be skimmed off. S. S. SADTLER.

**Methods of Testing Cement for Water Proofing Properties.** BY W. PURVES TAYLOR. *Chem. Eng.* August, 1906, p. 150.—The methods of determining the porosity and permeability of cement mortars have been found to be satisfactorily accomplished by making a disk of concrete (1-3) which is clamped at the end of a  $3\frac{1}{4}$ -inch brass pipe. Water under 10 pounds pressure is forced in the other end of the pipe and the number of cubic centimeters per minute passing through is recorded, and gives a measure of the permeability.

The porosity is determined by air drying a piece of the concrete, weighing, soaking in water forty-eight hours, and reweighing. The percentage of absorption is noted. S. S. SADTLER.

**On the Resin Content of India Rubber.** BY LYMAN M. BOURNE. *Chem. Eng.* August, 1906, p. 166.—The amount of resin in India rubber is not an absolute indication of its value, but in the same kind of rubber the value varies inversely as the amount of resin contained. The amount of true rubber is determined by dissolving the sample in benzene and adding alcohol until all the rubber is precipitated. It is then decanted and filtered on silk, the precipitated rubber washed several times with alcohol and dried at  $80^{\circ}$  *in vacuo*, for two hours. The sampling is difficult. Pieces should be taken from every sheet as it comes from the wash rolls, and then those pieces are agglomerated into one sheet and a sample taken for analysis. A table is given, of which the following shows the averages of the analyses most frequently made.

Trade name and geographical origin.	No. lots analyzed.	Per cent. rubber.	Resin.	Approx. shrinkage.	Imp.
Assam prime, India.....	6	84.2	15.8	25	Bark and sand.
Caucho ball, Brazil.....	24	90.0	10.0	33	" "
Caucho sheet, ".....	14	91.0	9.0	38	" "
Caucho slab, ".....	13	86.8	13.2	33	" "
Congo, Upper Congo.....	7	86.3	13.8	16	
Guayaquil Strip, Ecuador (Columbia).....	7	89.8	10.2	30	
Para, fine, Brazil.....	23	96.6	3.4	17	
Para, medium, Brazil.....	9	95.2	4.8	17	
Pontiac, W. Borneo.....	7	25.0	75.0	60	

S. S. SADTLER.

**The Petroleum of North America. A Comparison of the Character of Those of the Older and Newer Fields.** BY CLIFFORD RICHARDSON. *J. Franklin Inst.* July, 1906, pp. 57-70.—Petroleum is classed as one of the native bitumens, which is liquid at ordinary temperatures.

*Distribution. Development of Petroleum as an Industrial Product in North America.*

Production of petroleum in the U. S. 1899-1904.

Rank of petroleum-producing fields, according to the value of the product, in 1904.

Rank of petroleum-producing states and territories according to production in 1904.

Rank of petroleum-producing states and territories according to the value of the product, in 1904.

*Character of the Petroleum of North America. Appalachian Field.*

Volatility in open dish. Viscosity of residue. Distillation in Engler's flasks. Specific gravity and refractive index. Distillation *in vacuo*.

The ultimate composition of the crude oil and of a residuum obtained by spontaneous evaporation of the oil in a current of air.

Characteristics of the various saturated hydrocarbons of the  $C_nH_{2n+2}$ ,  $C_nH_{2n}$  and  $C_nH_{2n-2}$  series, as described by Mabery and Young.

Comparison of paraffin petroleum, Trinidad asphalt, California petroleum (Mabery), and California petroleum (Richardson).

Physical and chemical properties, including ultimate analyses of the residuum of Pennsylvania petroleum.

S. S. SADTLER.

**The Petroleum of North America. A Comparison of the Character of Those of the Older and Newer Fields.** BY CLIFFORD RICHARDSON. *J. Franklin Inst.* August, 1906, pp. 81-128.



*Ohio-Indiana Field.*

Comparison of distillates of the Pennsylvania field and Ohio-Indiana field.

Hydrocarbons separated from Ohio-Trenton limestone petroleum.

Comparison of the characteristics of Trinidad asphalt, etc., California oil, etc., and Beaumont (Texas) oil.

Physical and chemical properties of the oils of this field.

*Canadian Field.*

Comparison of ultimate analyses of oils from the Ohio and Canadian fields.

Comparative yield of distillates from Canadian, Ohio and Pennsylvania oil fields.

Physical properties of separated constituents of the Ohio oil field.

Physical and chemical properties of the residuum of Canadian oil field.

*Colorado Field.*

Physical and chemical properties of the oils of this field.

*Wyoming Field.*

*California Field.*

Distillation record of an oil from Summerland field, Santa Barbara County, showing the character of a dense oil of this kind. Ultimate analyses of the same.

Hydrocarbons separated from Santa Barbara (Cal.) petroleum.

Santa Barbara County, La Graciosa District. Los Angeles and Orange Counties.

Distillation of petroleum of Eastern Los Angeles County field. Loss by treatment with different reagents.

Physical and chemical properties of California residual oil (Grade G).

Physical and chemical properties of California residual pitch (Grade D).

Los Angeles County.

Oil from the Fullerton oil wells of the A., T. and S. F. R. R.

Results of treatment of the distillates of the foregoing oil with sodium hydroxide, showing phenols and bases.

Density of distillates before and after treatment.

Ventura County.

Oil from Ojai Valley.

Bardsdale oil before and after treatment with sodium hydroxide.

Torrey Canyon oil before and after treatment.

Four Forks oil before and after treatment.

Central Valley of California.

Kern County oil. Distillates of the same.

Distillates before and after caustic soda treatment of heavy oil of Sunset district.

*Texas Field.*

Bexar County district. Nacogdoches County. Brazoria County. South Basque district. Henrietta district.

Corsicana field. Distillation records.

Physical and chemical properties.

Records of treatment with caustic soda, sulphuric acid, etc.

Beaumont oil. Ultimate composition, physical properties, distillation, acid treatment, etc., as compared with Pennsylvania oil.

The comparison of distillation and physical properties of Beaumont oil and Los Angeles (Cal.) oil.

Physical and chemical properties of heavy residuum oil, Beaumont, Texas.

Residual pitch from Beaumont (Texas) oil.

*Other Fields, Texas.*

*Kansas Field.*

Physical and chemical properties and distillation records.

*Louisiana Field.*

Physical and chemical properties and distillation records.

*Alaska Field.*

Distillation records.

*Cuban Field.*

Examination of maltha.

*Mexican Field.*

*Comparison of North American Petroleums.*

S. S. SADTLER.

**The Proximate Composition and Physical Structure of Trinidad Asphalt.** BY CLIFFORD RICHARDSON. *Eng. Rec.* June 30, 1906.—Asphalt from the lake in the Island of Trinidad consists of an emulsion of bitumen, clay and water. In all published analyses there has been an undetermined residue generally called organic non-bitumen. As water is an almost invariable constituent of clays, it was supposed that water might account for a large portion of the discrepancy. Such was found apparently to be the case, as artificial mixtures showed the same losses.

**ANALYSES OF MIXTURES OF PURE BITUMEN WITH VARIOUS MATERIALS.**

	Bitumen soluble in carbon disulphide. Per cent.	Mineral residue on ignition. Per cent.	Undetermined. Per cent.
Fuller's earth, air-dried .....	62.3	28.8	8.9
Fuller's earth, ignited.....	59.7	34.1	6.2
Brick clay, air-dried.....	72.3	22.9	4.8
Brick clay, ignited.....	77.9	17.9	4.2
Portland cement, ignited.....	82.6	15.8	1.6
Trinidad mineral residue, ignited	64.4	34.3	1.3

In addition to the loss due to water, when the residue from the extraction with solvents is ignited it was found that the clays have the power of absorbing certain constituents of the asphalt as was proven by allowing carbon disulphide, containing a little bitumen, to pass through clay.

S. S. SADTLER.

## AGRICULTURAL CHEMISTRY.

**On the Detection of Formaldehyde in Milk.** BY S. F. ACREE. *J. Biol. Chem.* 2, 145-149.—When milk containing a trace of formaldehyde is mixed with an equal volume of water and four volumes of concentrated sulphuric acid in which there is a small amount of a ferric salt the solution soon acquires a violet color. This reaction may be made quantitative by means of colorimetric estimations but only in dilute solutions of formaldehyde. The test is so sensitive that 1 part of formaldehyde in 200,000 of milk can be readily detected. It is probable that the formaldehyde forms a loose chemical combination with the proteids of the milk and that the color is produced by the action of the ferric salt and sulphuric acid upon the formaldehyde proteid compound.

F. P. UNDERHILL.

**The Normal Distribution of Chlorine in the Natural Waters of New York and New England.** BY D. D. JACKSON. *Bull.* 144, *U. S. Geol. Survey*.—A discussion of the chlorine content as indicative of the pollution of water supplies. A large number of determinations are reported from which to determine the normal chlorine content of natural waters of New York and New England, and from which maps showing "isochlors" have been constructed.

W. W. SKINNER.

**Paris Green.** BY R. HARCOURT. *Am. Report Ontario Agr. College and Expt. Farm*.—A study of the chemical composition of Paris green. The analyses of numerous samples are given in which the soluble arsenious acid varied from 2.11 per cent. to 4.35 per cent.

W. W. SKINNER.

**Spraying Mixtures and Machinery.** BY F. L. STEVENS AND R. S. WOGLUM. *Bull.* 193, *North Carolina Expt. Sta.*—Directions are given for the preparation of insecticides and fungicides and also the use of apparatus. Suggestions are given for the best methods of treating common insect pests and fungus diseases.

W. W. SKINNER.



**Home Modification of Cow's Milk.** BY MACEY F. DEMING, M.D. *N. Y. Med. J.* 84, 219 (1906).—The author has perfected a device, consisting of a 16-ounce graduate to measure both ounces and percentages, which does away with calculations whenever a modified milk is to be made. "The first column on the graduate is graduated from 0.2 per cent. to 2.40 per cent. proteids." The other columns at the right are the fat percentages obtained when milks containing 4 per cent., 7 per cent., 10 per cent. and 12 per cent. of fat are used. The milk containing 4 per cent. fat is whole milk; the others are top milks to be removed from a quart of good milk, by the use of a special dipper, which together with the graduate is shown in accompanying cuts. To make modified milk of any percentage of fat, whole milk or top milk is poured into the graduate up to the desired percentage, and a diluent is added to the graduation marked "top line," making 16 ounces. Directions are given stating what kind of milk to use to secure the required modification. As a basis for the graduation, it is assumed that ordinary whole milk contains 4 per cent. fat and 3.20 per cent. proteids; therefore, if one ounce of this milk be used, and diluted to the top line or 16 ounces, the percentages of fat and proteids will be 0.25 per cent. and 0.2 per cent. respectively, and these figures are placed on the first graduation. Likewise, the use of 2 ounces of whole milk diluted to 16 ounces will make the basis for the second graduation, *i. e.*, 0.50 per cent. fat and 0.40 per cent. proteids. Although the graduate is made for milk containing 4 per cent. fat, yet milks containing anywhere from 3.6 per cent. to 5 per cent. fat may likewise be used as a basis without introducing any considerable error.

J. A. LEClerc.

**Whole Milk, Skim Milk, Buttermilk and Cream, 1906.** BY THOMAS MACFARLANE. *Lab. Internal Revenue Dept., Ottawa, Bull.* 121.—367 samples of milk, skim-milk, buttermilk and cream were collected in the various districts of the Dominion, bichromate (1 part per 1,000 of milk) being used as the preservative. When a whole milk contains less than 8 per cent. solids-not-fat, and fat is below 3.75 per cent., it is considered "watered." When solids-not-fat are 8.5 per cent. or over and fat is lower than 3 per cent., the milk is "partly skimmed." When such a sample falls below 2 per cent. fat, it is "skimmed." Fourteen per cent. of the samples were found adulterated, a larger amount than in previous years. Cream varied from 12.6–33.5 per cent. fat, that over 25 per cent. being "whipping" cream.

J. A. LEClerc.

**Wyoming Forage Plants and Their Chemical Composition.** BY H. G. KNIGHT, F. E. HEPNER AND AVEN NELSON. *Wyo. Expt. Sta., Bull.* 70. Studies No. 2.—Laramie is situated over

7,000 feet above sea-level. Plants grown at this altitude vary much in composition and digestibility from plants grown at lower altitudes and in more humid climates, forage plants grown in Wyoming containing more fiber and protein, but less fat. The season in Wyoming is short, and nights cool; the days, however, are very warm in the direct rays of the sun. Plants have to adapt themselves to these conditions and so mature early, producing the most nutritious forage plants found anywhere. Western wheat-grass is a more valuable fodder than timothy, which is the standard hay of the east. Plants in bloom were collected over a wide area of the state at elevations varying from 7,000-9,000 feet. These plants are described from the botanical standpoint, and the results of the chemical analyses given, both in the green, and air-dried condition. All the forage plants are illustrated.

J. A. LeCLERC.

**Macaroni or Durum Wheats.** BY JAS. H. SHEPARD. *S. D. Agr. Expt. Sta., Bull. 99.*—This is a continuation of the work published in Bulletin 92. The wheats were grown at Highmore, S. D., in 1904 and 1905, the former season being most ideal for this class of wheat. 1905 was somewhat too wet. The weight per bushel of the best varieties was almost 64 pounds. As in the former bulletin, comparison was made with Red Fife wheat. The wheat grown in 1904 was superior to that grown the following year, again showing that durum wheats thrive best under dry conditions. In all varieties of wheat the percentage of nitrogen was lower when grown in a wet season. Tables show that Kubanka wheat contains less bran than the other varieties, likewise less shorts, but produces more flour. The percentage of protein in flour from 6 varieties of Russian durum wheats is over 12.5 per cent., whereas in Fife wheat flour it is 11.5 per cent. The flour of durum wheat contains over 65 per cent. of the total protein of the whole wheat; Fife wheat flour contains only 55 per cent. On the other hand Red Fife wheat flour contains more gliadin than do the durums. The result of these two bulletins shows that Kubanka No. 5639 is the best durum wheat for South Dakota conditions.

J. A. LeCLERC.

**Maple Syrup and Sugar, 1906.** BY THOMAS MACFARLANE. *Bull. 120, Laboratory of the Inland Revenue Dept., Ottawa, Canada.*—The bulletin gives the report of the examination of 334 samples of maple syrup and sugar of which 129 were found to be adulterated or below standard. The analytical work reported is confined to the basic lead acetate precipitate and total ash.

W. D. BIGELOW.

**Curing of Codfish.** BY HENRY BORDEWICH. Consul-General

of Christiania. Daily Consular and Trade Reports, Dept. of Commerce and Labor, October 10, 1906.—The article is the result of an inquiry into the investigation relative to the curing of codfish without the use of preservatives. The methods employed in Norway for the preservation of fish are given in detail. The fish are preserved either by air-drying or by curing with salt. No other preservatives are found desirable or necessary.

W. D. BIGELOW.

**Experiments on the Digestibility of Fish and Poultry.** By R. D. Milner. *Report of Storrs Agr. Expt. Sta. 1905*, p. 116.—The article gives the results of a study of the digestibility of salmon, cod, chicken and duck, using men as subjects. In all, 16 individual experiments were conducted. While the author regards the volume of the work as too small to warrant definite conclusions, it would appear that in the foods studied the coefficients of availability are approximately those previously found for other animal foods. The foods containing a considerable portion of fat were apparently as completely digested as those in which the percentage of fat was relatively small.

W. D. BIGELOW.

**Dietary Studies of a Week's Walking Trip.** By H. L. KNIGHT. *Report of Storrs Agr. Expt. Sta. 1905*, p. 143.—The article is a report of a dietary study upon two young men of sedentary habit while on a week's walking trip.

W. D. BIGELOW.

**Extractor for Tanning Materials.** By W. H. TEAS. *J. Am. Leather Chemists*, **1**, 274 (1906).—A general discussion of the merits of the three forms of extractors in general use on tanning materials. The almost universal applicability of the Zulkowsky type (this Review, **11**, 689) is recognized, and a modified form which permits the removal of the extract either by direct percolation or by siphoning, during operation, is figured. A multiple form of the Kerr percolator previously described (this Review, **12**, 115) is also figured.

F. P. VEITCH.

**Cotton Plant.** By C. B. WILLIAMS. *Bull. N. C. Dept. Agr.* September, 1906.—The fertilizer constituents of the several parts of the plant grown under different fertilizer treatment of the same soil are tabulated and discussed. The percentage of the several constituents shows no obvious relation to the fertilizer treatment. The proportion of kernels and hulls of different varieties is given together with their chemical composition. In experiments on the effect of fertilizers on maturity it was found that all fertilizers tried hastened maturity greatly, high phosphoric acid fertilization on sandy and sandy loam soils and heavy complete fertilization on red clay soils giving the largest percentage of cotton open at the first picking. Normal complete



fertilization gives larger first pickings than high nitrogen fertilizations. High nitrogen gives larger first pickings than high potash fertilization.  
F. P. VEITCH.

**Commercial Fertilizers.** BY G. ROBERTS. *Bull. 179, Cal. Agr. Expt. Sta.*—Tabulations of analyses and valuations of 239 samples collected during the last half of 1905–1906 are given.  
F. P. VEITCH.

**The Underground Waters of Mississippi.** BY W. N. LOGAN AND W. R. PERKINS. *Bull. 89, Mississippi Expt. Sta.*—This bulletin classifies the underground waters with reference to chemical composition, and outlines the principal artesian areas of the state. The predominating salts, in many of the waters, were found to be sodium carbonate and sodium chloride.  
W. W. SKINNER.

**Dried Cotton Cultures Once More.** BY GEO. T. MOORE. *Science*, 24, 376.—The author wishes to refute the findings of Messrs. Harding and Paucha and other experiment station workers that the ordinary cultures found on the market are practically worthless. To support him in this he mentions the “thousands of satisfactory reports” received from farmers in this country and the results obtained by experiment stations in Great Britain, Australia, New Zealand, S. Africa and China. The work of Great Britain is summed up as follows: “The experiments in which *positive* results were obtained show that in *many* cases both Moore’s and Hiltner’s cultures were alive.”  
J. H. PETTIT.

## PATENTS.

JUNE 12, 1906.

822,929. Carl Dellwik, London, England. Assignor to J. E. Goldschmidt, Frankfort-on-Main, Germany. **Nodulizing ores.** The method of heating a kiln which consists in limiting the sintering zone to a short distance from the discharge end by an intense flame, and using lower grade fuel and lower temperature for the preliminary stages of conversion in the top of the kiln.

822,946. Paul R. Herschman, Freeport, Ill. Assignor to Charles L. Kiewert Co., Milwaukee, Wis. **Paint.** Shale oil 100, sulphur 5, manganese peroxide 3 parts by weight.

822,980. Marius Otto, Paris, France. Assignor to American Ozone Co., Niagara Falls. **Ozonizing water.** A series of concentrically arranged compartments opening in opposite directions one into the other, the outermost of said cylindrical compartments being provided with a discharge outlet, and one of the inner compartments having a separation chamber and a safety-valve.

823,038. Frederick W. Dunnell, Springfield, Mass. Assignor to P. A. Donaghue, J. J. Murphy and others, same place. **Composite block.** Shredded leather is saturated with water, and mixed with coal tar pitch, resin and oil, molded and pressed.

823,054. Wm. A. Koneman, Chicago, Ill: Recovering **rubber.** Shredded rubber waste is boiled in dilute sulphuric acid containing a halogen, then boiled in alkali, and thoroughly washed.

823,097. John W. Bailey, New York, N. Y. **White lead.** Assigned to United Lead Co., N. J. A car is loaded with trays of comminuted lead, and they are pushed successively into the corroding chamber on guides, a stream of acid playing on them meanwhile.

823,110. Marion Dorset, Washington, D. C. **Hog cholera antitoxin.** Assigned to the public under Chapter 143, Act of Congress, March 3, 1883. Pigs immune to hog cholera are inoculated with defibrinated blood from pigs sick with hog cholera, to hyperimmunize the treated pig, and form in its blood the protective substances to prevent hog cholera, drawing off the blood from the treated pig and separating the serum for use, to which is added a preservative. The inoculation may be repeated with larger injections.

823,205. George D. Coleman, Brookline, Mass. **Structural preservative.** A layer of slow drying paint is applied to the surface in which granulated lead is embedded, and over this is put a coat of Portland cement.

823,246. Julius Wessel, New York, N. Y. **Waterproofing composition.** White paraffin 75, stearic acid 5, and petroleum distillate sp. gr. 0.875 to 0.945, known as albolene 25 parts. Does not discolor fabrics.

823,287. Max Mayer, Berlin, Germany. **Measuring device for corrosive liquids.** A containing vessel is provided with apertures top and bottom opposite each other, and a tube extending from one to the other, but held above the lower opening by a spring, and a valve seated in its lower end. When this tube is pressed down it enters the lower opening to close it from the vessel, and to deliver outside the contents of the tube.

823,294. Karl Schirmacher, Höchst-on-Main, Germany. Assignor to Meister, Lucius und Brüning, same place. **Vat dye.** The glycine of dianthranilic acid is heated with alkali and the indoxyl formed is oxidized to indigo as usual.

823,330. Mathias Hennen, Minneapolis, Minn. **Weather-proof paste.** Putty 80, pumice stone 4, Japan varnish and raw linseed oil 2 parts each, butter of antimony, turpentine and acetic acid one part each by weight.

823,355. Maurice G. Olivier, Paris, France. **Protective covering for bottles, etc.** Viscose (cellulose xanthogenate)

is precipitated on a bottle, making a jacket slightly larger than the bottle and a neck formed for a cap or covering.

823,361. Michael Potalowsky, Moscow, Russia. **Purifying fish oils**, etc. Twenty per cent. of sulphuric acid is added to the oil and enough ground nitrites to make 5 per cent. of free nitrous acid, the temperature being kept below 60°, stirring, steaming and washing the mixture.

823,366. Curt J. Roehr, Philadelphia, Pa. **Treating distillers' slop**. Glycerol, dextrin and lactic acid are recovered from the slop, by precipitating the proteids with mineral matter dissolved in alkali, filtering and concentrating the resultant liquid.

823,435. Erich Opperman, Höchst-on-Main, Germany. Assignor to Meister, Lucius und Brüning, same place. **Electrolysis of organic compounds**. Electrolyzing organic substances in an acid bath with a compound of vanadium.

823,472. Rudolph Knietsch, Ludwigshafen-on-Rhine, Germany. Assignor to General Chemical Co., New York, N. Y. **Sulphuric anhydride**. Mixtures of sulphur dioxide and oxygen are exposed to successive contacts with separated bodies of contact material, by which the conversion is effected in instalments, with the pressure at or below that of the atmosphere, and maintaining the zone of ultimate reaction below the decomposing temperature of sulphur trioxide by cooling action intermediate of the contacts.

JUNE 19, 1906.

823,508. Louis Castets, Dax, France. **Apparatus for extracting tannin**. Three egg-shaped extracting vessels are arranged in a row with overhead connecting pipes, air pump and cooling coil in one of said vessels, adapted to extract tannin by cold, and in a vacuum.

823,560-1. Enrique A. Touceda, Albany, N. Y. **Metal-lurgical process and apparatus**. The first, the art of converting into electrical energy the heat emanating from a metal-lurgical furnace, and converting said electrical energy into heat within the furnace, the second for a furnace to do the process of the first patent, being a reverberatory hearth connected to a steam engine and dynamo, and arc electrodes within the furnace.

823,573. Scott K. Wilson, Grand Rapids, Mich. **Broom corn excelsior**. Broom corn clippings are washed, soaked twenty-four hours in caustic soda solution, then washed and slowly dried.

823,576. Craig R. Arnold, Philadelphia, Pa. **Extracting metals**. Air is sucked, first through a halogen gas generator, then through a pulp containing the cyanide salts, and in volume



enough to agitate the same, the waste and gases carried through an absorption tank and through a column of liquid before allowing any to escape.

823,673-4-5-6. George S. Duncan and George H. Potts, Edinburgh, Scotland. Assignors to American Offset Co., New York, N. Y. **Composition to prevent offsets in printing.** Turpentine 1, soap  $\frac{1}{4}$  part, olive oil, naphtha, neat's foot oil, and methylated spirits 2 parts each by weight. The others substitute different kinds of oil, as lard oil and sperm.

823,793. Thilo Kroeber, Basle, Switzerland. Assignor to Firm of Chemical Industry, same place. **Diazo dye and process of making.** One molecule of the tetrazo derivative of diaminophenol ( $\text{OH}, \text{NH}_2, \text{NH}_2 = 1,2,4$ ) is combined with an azo dye to form an intermediate compound, which is further combined with another molecule of the azo dye. A sulphonated naphtholic compound may be substituted for the azo dye. Dyes violet to black.

823,801. Gustavus Michaelis, Albany, N. Y. Assignor to Albany Chemical Company, same place. **Paint remover.** Alcohol 62, benzene 35, and petrolatum 3 parts.

823,859. Friedrich Grosche, Ilmenau, Germany. **Shaker for thermometers.** A handle having at its outer end an elastic portion and a catch to hold the thermometer, so that a quick return of the mercury is assured after using.

823,896. Georges Ranson, Brussels, Belgium. Assignor to Eugene Marlier, same place. **Zinc sulphide.** A mixture of barium hydroxide, metallic zinc and water is heated, which produces barium zincate and hydrogen, then a solution of barium sulphide of 230 grams per liter is added.

824,012. Charles R. Harris and Christopher C. Barrick, Los Angeles, Cal. **Plaster.** Clay 1000, calcined plaster 900, cement 400, and fiber as required.

824,015. Harry E. Heath, Lynn, Mass. Assignor to General Electric Co. **Thermo-electric couple.** One member of each couple is made of cast silica.

824,048. Elihu Thompson, Swampscott, Mass. Assignor to General Electric Co., N. Y. **Insulated coil.** A flat metallic conductor is wound edgewise into an open helix, saturated with silicious matter and sodium silicate, the helix closed and heated to vitrify the compound.

824,069. Francis E. Dunnett, London, England. Assignor to Humidine Limited, same place. **Non-corrosive paint.** Eighty parts of petrolatum are melted and combined with 10 parts asphalt, 7 of wood tar and 3 of Paris green.

JUNE 26, 1906.

824,092. Rudolph Brunck, Dortmund, Germany. **Obtaining ammonia.** Gases evolved in dry distillation are washed while hot with concentrated acid in a scrubber, regulating the absorption of ammonia so that the solution does not become oversaturated, removing the hot solution and cooling the same.

824,103. Wilbur B. Driver, East Orange, N. J. **Alloy.** Copper 75, nickel 20, manganese 5 parts.

824,112. Jacob R. Greene, Jr., Washington, Pa. Assignor to Eugene Vezie and John Winsor, same place, and Charles R. Ballard, Midway, Pa. **Boiler cleaning compound.** Green coffee 160, balsam weed, yarrow and graphite 1 part each.

824,116. Eduard Heber, New York, N. Y. **Extracting gum.** The vegetable matter containing gum is heated in a soap solution till the gum is dissolved or emulsified.

824,255. Wm. Mather, Julius Hubner and Wm. J. Pope, Manchester, England. **Mercerizing.** The fabric is rolled up together with an alternating layer of pervious, non-extensible and non-absorbent fabric, the roll being first steamed and wetted, then the mercerizing fluid forced through, and the goods finally washed.

824,280-1. Wm. B. Chisolm, Charleston, S. C. **Fertilizer.** Sulphur and phosphatic material are finely ground together. The second is for a special grinding apparatus. The process of grinding the sulphur and phosphate rock together dispenses with the use of sulphuric acid. May be used as an insecticide.

824,294. Robert G. Griswold and Wm. T. Donovan, Quincy, Mass. **Laundry blue.** Aniline blue 192, sodium bicarbonate 74, tartaric acid 114, carbolic acid 12, calcium hypochlorite 10, and saccharin, glucose or dextrin 2 to 4 parts.

824,320. Niels J. H. Weitzmann, Malmoe, Sweden. **Cleaning coffee.** The coffee is passed through a powerful magnetic field while agitated.

824,357. Arnold H. C. Heitmann and Erik U. Clemmensen. Assignors to Parke, Davis & Co., of Michigan. **Ethoxyphenylcamphorylimide.** Camphoryl chloride (?) and an alklyoxyphenyl radical are boiled together in carbon tetrachloride. The product appears in silky needles, melting at 119°. Colorless, odorless, tasteless, insoluble in cold water, soluble in most organic solvents, insoluble and not decomposed in acid or alkaline solutions.

824,398. Charles E. Acker, Niagara Falls, N. Y. Assignor to Acker Process Co., of N. J. **Oxygen compounds of tin.** A hydrated oxide of tin and chlorine are obtained by reacting with a hypochlorite on tin chloride, and withdrawing the chlorine without any access of air. Calcium hypochlorite preferred.

824,459. Louis Werliin, Elsmere, Del. **Purifying ammonia.** In refrigeration, compressing a part of the gas, cooling the whole by the expansion of the part compressed, condensing the impurities by the cold thus produced, and mixing and compressing again the entire mass of gas.

824,475. Hugo Friedmann, Charlottenburg, Germany. **Ink vehicle.** Dammar resin 150, mineral oil 50, glycerol 400, linseed oil varnish 200 parts. Used as a vehicle for printing inks.

824,539. Richard Griese, Berlin, Germany. **Internal remedy.** Sodium bicarbonate added to *m*-iodo-*o*-hydroxyquinolinesulphonic acid in equal parts by which it is rendered capable of being carried into the blood circulation. A few drops of peppermint oil and tannalbin may be added.

824,618. Charles H. Birmingham, Baltimore, Md. **Alloy.** Bismuth 1, silver 33, gold 5 and nickel 134 parts.

824,644. Paul Guhrs and Albrecht Guhrs, Berlin, Germany. **Mode of making zinc alloys.** An alloy is first made of aluminum and zinc equal parts, and bismuth 0.5 per cent. and a little added to prevent "hard zinc" in melting zinc.

824,663. Wm. Koehler, Cleveland, Ohio. **Reducing ores.** Heated sulphide ores are subjected to anhydrous halogen acid gas in the presence of anhydrous gaseous nitric acid.

824,675. Parascheva Sechiari, Paris, France. Assignor to Société Anonyme du Grimson, Charentin, Seine, France. **Cork fabric.** Sheets of cork are treated with a solution of pure rubber in benzine, then cemented to a fabric, by rubber cement, and the whole vulcanized.

824,680. Leendert L. D. Zuyderhoek, Amsterdam, Netherlands. **Coke briquets.** Lime 6, Portland cement 2, to powdered coke 100 parts add 15 parts water, mix and mold.

WM. H. SEAMAN.



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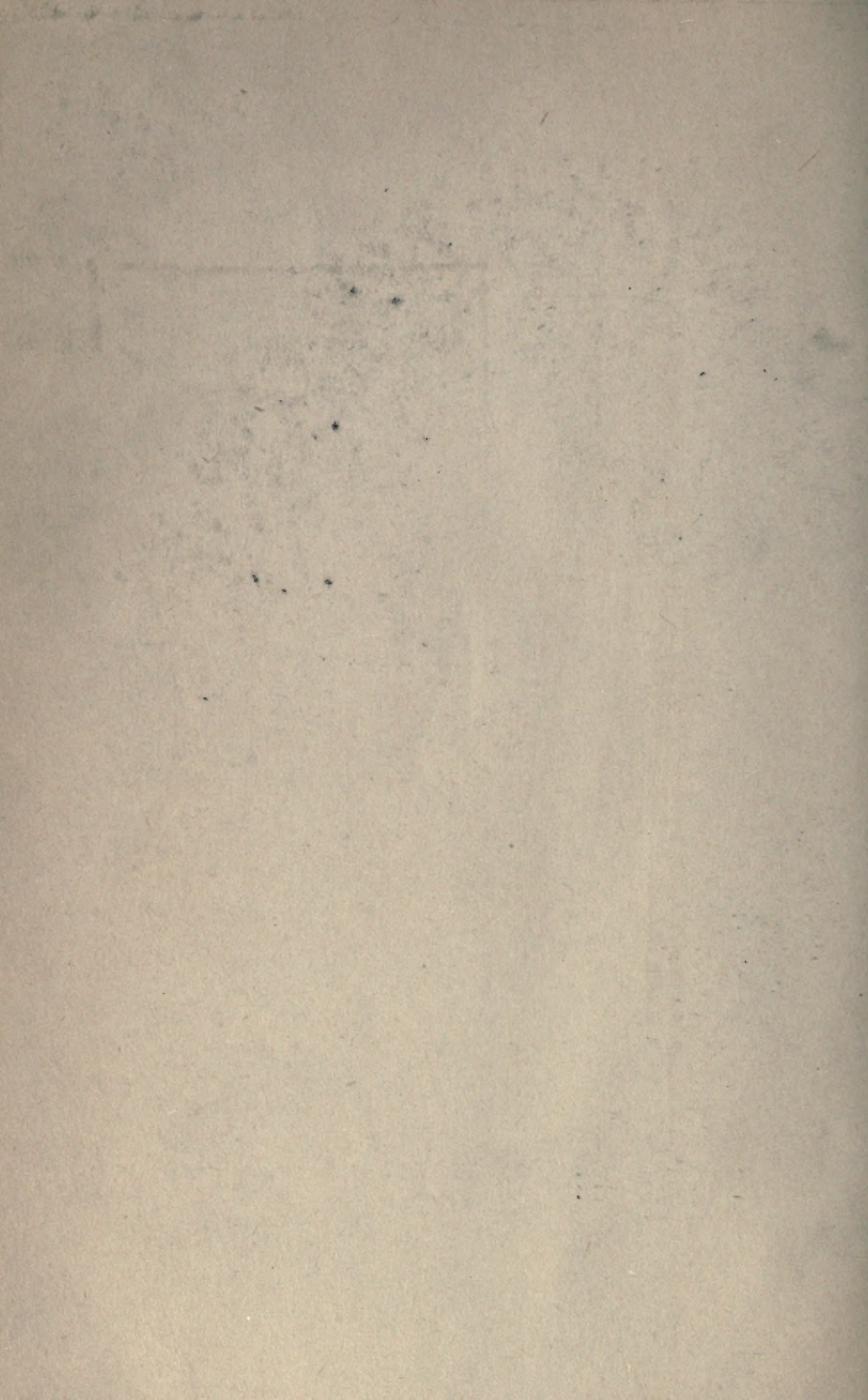












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